THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

HEARINGS

[Including the Record of a Seminar Sponsored by the American Association for the Advancement of Science on July 28, 1981.]

BEFORE THE

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SCIENCE, RESEARCH AND TECHNOLOGY
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SCIENCE AND TECHNOLOGY
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*On assignment to Budget Committee for 97th Congress.

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THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

WEDNESDAY, SEPTEMBER 9, 1981

U.S. House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9 a.m., in room 2318, Rayburn House Office Building, Hon. Stanley Lundine presiding.

Mr. Lundine. The subcommittee will come to order. Today, the subcommittee on Science, Research and Technology commences 6 days of comprehensive hearings on the human factor in innovation and productivity.

First of all, without objection, I would like to have a report prepared by the staff of the subcommittee spelling out some of the issues to be addressed in this series of hearings to be made a part of the record at this point. Without objection, it is so ordered.

[The information follows:]

Hearings on the Human Factor in Innovation and Productivity

September 9, 10, 11, 15, 16, 17, 1981

ISSUES TO BE EXPLORED

Summary and Introduction

These hearings will focus on issues associated with management, labor, and their interrelationships, as they pertain to innovation and productivity. The hearings are investigative and educational and are not directed towards legislation. They are a continuation of the innovation and productivity program of the Subcommittee on Science, Research and Technology conducted during the 96th and 97th Congresses.

I. Basic Issues

A. Management

1. What is the importance of long-term and short-term management strategies? How can the promotion and reward systems of top management be set to insure sufficient concern with the long term?

2. How can top management be made to have sufficient knowledge of technology and be comfortable enough with technology to manage new technological enterprises effectively? Do we need more engineers and scientists as managers?

3. What kinds of analysis should be applied by top management to determine whether to proceed with technological ventures? Financial analysis alone is not sufficient.

4. How can entrepreneurial behavior in managers be fostered? Can it be taught?

5. What kinds of skills and expectations should managers have to work effectively with labor?

B. Labor

1. How can technology be designed and implemented to be compatible with the abilities and needs of workers?

2. What promotion and reward systems or social arrangements in the workplace will assure high-quality products, foster a sense of caring about doing a good job, and lead to worker satisfaction?

3. Will the introduction of new technologies lead to increased employment or increased unemployment?

4. Where the introduction of new technologies changes the nature of work, what training programs or other action should be taken to insure the well-being of the worker?

5. Will there be an adequate supply of engineers, technicians and other skilled workers to permit the implementation of new technologies? (The answer is no.) What can be done about this situation?

C. Labor-Management Relations

1. What types of labor involvement in decision-making are effective to promote worker satisfaction, high quality work, profitability of the firm, etc?

2. What types of worker involvement in the design or introduction of new technologies are effective in ensuring worker acceptance of new technologies?

II. Cross-cutting the basic issues

A. What is United States experience in the basic issues? Of the witnesses, Mr. Maccoby and Mr. Brooks should be able to give a broad overview. Mr. Hanes, Mr. Bernardi, and Mr. Demeré will be able to tell how three companies deal with these issues. Mr. Straw and Mr. McBride will give the labor viewpoint.

B. What is foreign experience in these matters? Can foreign techniques be used in this country?

1. Japan - Mr. Arai, Mr. Wada, and Mr. Yawata will describe Japanese experience. Mr. Wood manages a company which has come under Japanese ownership and can comment on the effects.

2. Norway - Mr. Thorsrud will describe Norwegian experience as well as giving an overview of the issues.

3. Sweden - Mr. Jonnson will describe his experience with Volvo.

C. What can the Federal government do to assist with the human factor in innovation and productivity? All the witnesses can be asked this. Mr. Usilaner's testimony will address this question directly.

D. What can other organizations contribute? Mr. White will describe the work of the American Productivity Center, and Mr. Rahn will describe the work of the Productivity Center of the U.S. Chamber of Commerce (as well as a survey of management attitudes). Mr. Balzer will present the results of research into worker attitudes.

E. What can research tell us about the issues, and what additional research is needed? Mr. Larsen will describe what NSF is doing to support research. Mr. Metzger will describe the work of the Profit Sharing Research Institute. Several other witnesses have been conducting research on these issues, too.

III. Examples

A. Office Technology - Mr. Driscoll and Mr. Gregory will discuss their research on office technology. Mr. Erwin will discuss effects on office life of video and audio teleconferencing, and Ms. Schimel will discuss the effects of word processors.

B. Air Control Technology - Mr. Koch will discuss employee participation in the design and implementation of air control systems.

IV. Other hearings

A. Management issues were the principal focus of a seminar sponsored by members of the Committee on Science and Technology and held by AAAS on July 18, 1981. Proceedings of the seminar will be printed with the record of the current hearings.

B. Engineering manpower [illegible]l be the focus of hearings to be held by the full Committee on [illegible]ence and Technology in October 1981.

Mr. **Lundine**. The trend reflecting the declining rate of productivity growth in the United States justifiably has had the best economists and policymakers troubled for some time. While the roots of the disturbing trend in productivity growth may have many beginnings and experts disagree more than they agree about the prescriptions needed to bring about the cure, it is evident that improving productivity performance is the essence of economic progress.

I believe that there are four basic areas which must be addressed if we are going to improve productivity in the United States: One, capital investment; two, research and development; three, regulatory reform, and four, human resource development. The last of these, human resource development, is the least understood factor affecting productivity performance, and in my opinion, in the long term, perhaps the most crucial. In an increasingly complex work world, the quality of the interaction between human beings will often be the factor that distinguishes a productive business undertaking from a failing one.

I have observed this phenomenon first hand when I was mayor of Jamestown, N.Y., and a joint labor-management program concentrating on improving the quality of work life utterly revitalized the local economy. Similar endeavors in many communities and industries are taking hold and improving the work experience of individuals and the competitiveness of many companies.

Abroad, we see great strides that have been made in Sweden, Norway, Germany and Japan from quality of working life programs.

The challenge before us in relation to human resource development grows steeper each day because of the tremendous pace of technological development, and what Alvin Toffler, in his fairly recent book, called "The Third Wave." We should have learned one thing over the years, however, and that is that there is no such thing as a "technological fix." And, as Americans, we must understand that it will not be sufficient to try to emulate what the Japanese are doing, or the Swedes, or the Germans. We need American solutions to American problems of the workplace, although we certainly can learn from our international competitors.

If we do not concentrate more of our efforts on understanding the interaction between human beings and the technological workplace, we may wake up one morning and discover that most of us have become alienated from our work experience, that the societal computer is down and disfunctioning badly. Continue technological development and innovation are critical to human progress. History clearly demonstrates this over and over again. At the same time, however, human beings must effect and control technological development.

We have before us over the next 6 days some of the outstanding people at the forefront of efforts to humanize technological development and progress. We hope, over the course of these hearings, to identify areas of research that are fundamental to learning more about how to effectively coordinate human resource development and technological development, and to identify and explore the policy implications related to technological innovation and human resource development.

We will hear from international experts from Sweden, Norway, and Japan, and from those in the United States who are dedicated to improving the human work experience. We will explore the opinion of both labor and management on this subject, and learn of some of the implications of the rapid change that is occurring in utilization of office technology. When it is all over, we hope to have some important and concrete conclusions about the role of human resource development in a changing technological world and some policy recommendations for Congress and others.

Today, I am honored to welcome my good friend, Michael Maccoby, author of the best selling book, "The Gamesman," and founder of the Harvard Project on Technology, Work, and Character. Also, we are fortunate to have with us today, and particularly welcome, Einar Thorsrud, probably the world's best known expert on the quality of working life; Brian Usilaner from the General Accounting Office, whose work in this field is absolutely outsanding, and Keiske Yawata, president of Nippon Electric.

Before asking my colleagues for opening remarks, I would like to thank Congressman Walgren, chairman of this subcommittee, both for allocating this amount of time—it is really extraordinary to have 6 full days of hearings on one subject—and also for inviting me to chair these hearings.

Mrs. Heckler.

Mrs. **Heckler**. Thank you.

Congress is used to hearing about the decline in American technological need and the related decline in productivity and innovation. There is no question that both have been slipping for some time and that our level of productivity and degree of innovation is decreasing. There have been a number of congressional hearings on these matters and even more reports and studies. These issues are important, but their congressional constituencies have only recently been established.

I would like to raise a point of these issues which I hope the hearings will explore. We talk of our—America's—technological capacity and a vast body of literature is developing on that topic. What I would like to see explored is America's social capacity: the capacity of Americans to cope, adopt, and excel in an increasingly technological society.

It is interesting to note that America is in the initial stages of incredible technological breakthroughs. Yet, little research is underway to determine how people will respond to the potential growth of technology, both in its use and production.

I was very impressed by the statement made by Dr. Gerald Holton of Harvard, who gave the Jefferson Lecture in Humanities earlier this year. He dedicated his lecture—the highest honor this country bestows on a professor of humanities—to the increasing gap between technology and the average citizen—seemingly, that growth has occurred much more quickly than our ability to adapt to it.

Despite recent setbacks, America has gained in its innovative and productive strength that allows us almost unlimited technological progress. However, our accomplishments in the technological mainstream have not brought the peoples' understanding into that mainstream. Our accomplishments in this area are virtually nonexistent. We are heading toward the technological disenfranchisement of the average American, I feel. Perhaps this is not true, but this seems to me to be a major problem. It was a problem that I believe Dr. Gerald Holton addressed.

I imagine that the first place the search will be undertaken in this area will be in the private sector. Industry will want to know how best to set up the technological and productive environment that is becoming one of great and vast complexity. Industry will be doing this not only to maintain its productivity stability but certainly to increase its productivity. This is not research for the future; we are not trying to lump strategies for future problems. It is research on the social dimensions of an increasingly technological society, one that seems to be placing greater emphasis on analytical detachment rather than on intuition and insight born of experience, which may explain to a significant degree the reason for this country's current economic malaise.

The economic environment has gone through quite an evolution in the last 4 years. To quote a Harvard article, "An approach refined may be ill suited to a world characterized by rapid change, scarce energy, global competition for markets, and constant need for innovation."

This is the world of the 1980's and probably the rest of the century. The world of the eighties is subject to Government regulation, inflation, monetary policy, labor issues, energy costs, tax laws, all of their constitutencies and agendas. The matter before us in these hearings will not have as much of a constituency, but deserves it. I look forward to the testimony of this very impressive group of witnesses and expect to learn from them today.

Thank you.

Mr. LUNDINE. Thank you.

Mr. Brown, do you have anything you would like to say?

Mr. BROWN. No, Mr. Chairman.

Mr. LUNDINE. Very well.

Mr. Maccoby, you may proceed as you see fit.

[A biographical sketch of Mr. Maccoby follows:]

April 30, 1981

MICHAEL MACCOBY

Michael Maccoby is a psychoanalyst and social psychologist. He lives in Washington, DC where he directs the Project on Technology, Work and Character, which is affiliated with the Kennedy School of Government, Harvard University. He is also on the faculty of the Washington School of Psychiatry.

Dr. Maccoby organized the Project in 1970 to study how management and new technology at the workplace affect human development. His book The Gamesman (1977) reported the results of interviewing over 250 managers in technology-based corporations on their goals and values. It was described by Newsweek as "the most provocative study of business executives since The Organization Man."

In 1973, Dr. Maccoby was invited by Harman International Industries and the United Auto Workers to help design the first American joint union-management program to improve the quality of working life. The "Bolivar Project" named after the factory town in Tennessee, became a model for many subsequent joint programs, and in 1981 Dr. Maccoby became consultant to the Communications Workers of America and AT&T in their joint efforts to improve the quality of working life and quality of service in the Bell System.

Dr. Maccoby has also been a consultant to pioneering programs to improve work and develop participative management in the Federal government, at the Department of Commerce and ACTION, where the local union (AFSCME) played a key role. He has been a consultant on managerial development at the Department of State.

Dr. Maccoby received his BA from Harvard in social psychology and studied philosophy at New College, Oxford. After receiving a Ph.D. from Harvard in Social Relations, he studied psychoanalysis under Erich Fromm and participated with him in a study of work and character in a Mexican village, co-authoring Social Character in a Mexican Village (1971). He is a fellow of both the American Psychological and American Anthropological Associations.

Dr. Maccoby has written many articles on the relationship between work and human development. His newest book, The Leader: A New Face for American Management (to be published by Simon and Schuster in the fall of 1981) is based on participant study in government, business and unions in both the US and Western Europe. It presents a new model of leadership for the 80s, one that will bring out the best in a society oriented to individual rights and self fulfillment.

STATEMENT OF MICHAEL MACCOBY, KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY

Mr. MACCOBY. Thank you, Congressman Lundine. I have long admired your leadership both at Jamestown and in Congress on these issues which are of such importance to our country.

As you pointed out, I am director of the Harvard Program on Technology, Public Policy, and Human Development, and over the past 10 years my colleagues and I have studied the process of technological and mangerial innovation in the United States, United Kingdom, and Scandinavia. Currently, I am consultant to the Communications Workers of America and A.T. & T. in their joint effort to improve the quality of working life and quality of service in the Bell System.

We are all aware that American industry must perform in a highly competitive international economy. This requires high levels of productivity and product quality, calling for both new production technology and new styles of management.

A clear example that we have all heard about is the auto industry. The Japanese understood the American market better than did GM, Ford, and Chrysler. When the price is right, quality and durability sell, and this requires workers who care and have time to fix mistakes, and management that invites them to help solve problems.

We have known for a generation that the management of technological innovation requires teamwork among scientists and engineers. We are now learning that it is also required for productivity in factories and offices. Hierarchical, policing style management causes resentment, sabotage, costly absenteeism, and a negative attitude to the business, particularly in a new era with values of self-affirmation.

The Japanese success at participative management and the GM-UAW quality of life program have dramatized the fact that properly organized, workers today can manage themselves, raising the level of performance and reducing the costs of administrative overhead and waste as they also find work more satisfying.

Furthermore, if adequately trained and informed, factory and office workers contribute to a continual process of innovation. Small improvements and cumulative savings add up and can be just as important as more dramatic innovations.

In the United States, two types of companies are at the frontier of managerial innovation. A couple of years ago the Commerce Department had a meeting which brought some of these companies together to testify on their change in philosophy and practices. It was called "The Frontiers of Management." One type is in many ways similar to Japanese paternalism. These are companies which guarantee job security and manage according to a philosophy which emphasizes respect for the individual and encourages continual learning.

Many include profit sharing. Obviously in companies like this, workers are very willing to adopt new technology because they are not afraid they are going to lose their jobs. Hewlett-Packard and Procter & Gamble are examples. In these companies, employees cooperate to develop and implement productive new technology.

They are willing to experiment with the new organization and job classifications, because they trust management.

The second type of innovative management is to be found in those unionized companies which are able to work cooperatively with a strong and progressive union and are not afraid of a strong union. General Motors and the UAW and A.T. & T. and the CWA are examples. By working in a limited partnership with the union, management gains cooperation and flexibility. Because their rights are protected and attention is paid to their concerns, workers are willing to participate in cutting costs and improving quality of service. Unions are flexible about job classifications and the introduction of new technology because they are able to limit the negative impact of these changes.

As American business reaches for new technology to improve productivity, it must re-examine its approach to design and engineering. Traditional production technology like the assembly line, built to maximize control and the interchangeability of people, no longer proves productive when compared with new sociotechnical designs such as those that have been built on the principle of increased teamwork and individual responsibility.

Notable examples are General Motors in the United States, and Volvo in Sweden. At one Volvo plant I visited, teams of workers have learned to take over managerial functions such as personnel, maintenance, planning, quality, et cetera. In a factory of 100 assemblers there are now only 2 engineering managers and a head plant manager, who told me he believes he has no further function and might as well leave the factory.

New forms of sociotechnical design become more feasible and necessary as computers and microprocessors allow decentralization and flexibility in designing away some of the worst jobs. In the future, as more routine jobs can be performed by robots, new jobs will demand intellectual skills, with greater autonomy and responsibility in offices as well as factories.

But making good use of new technology requires new attitudes and practices by management and union leadership. Otherwise, technology will not fulfill its promise of productivity. Prof. Richard Walton at Harvard Business School, has presented research showing that unless employees participate in the design and implementation of new office technology, costly resistance depresses performance. You will hear some more testimony on some of the effects of office technology that has not been managed in this way. Despite evidence to the contrary, some business and government agencies expect new technology to work efficiently according to the old hierarchical, controlling managerial principles.

It is significant that when he reviewed the findings on the Three Mile Island near disaster, John G. Kemeny, the head of the Commission, concluded that the failure was caused by human and mangerial and not technical systems. There was a management attitude that nothing could go wrong. In a nuclear powerplant, as in many large and delicate continuous processing facilities, like oil refineries or paper and pulp mills, workers who run the machines should have the training to handle emergencies and authority to make quick decisions. The hierarchal chain of authority is not only cumbersome and costly, and dissatisfying, but it is also dangerous.

In government, as well as business, managerial innovation pays off. I was impressed by the cooperation and innovation of city workers in Springfield and Columbus, Ohio in a QWL program developed by Ohio State with the participation of the American Federation of State, County and Municipal Employees. Refuse collectors in Springfield organized themselves in teams with CB radios so that those who finished their routes early could help others.

Here in Washington, I helped to establish a work improvement program in the Department of Commerce with the cooperation of the Federation of Federal Employees. Workers met to identify and solve production problems. The program has resulted in significant productivity gains and technical innovations suggested by the workers. Grievances practically disappeared.

I have observed elsewhere, such as the State Department, that managerial innovation makes a significant difference in how well offices function and how effectively new technology is designed and implemented.

Given that new approaches to management pay off, why don't more companies and government agencies adopt them?

One answer is that change is difficult, especially for managers with inflexible, rigidly controlling personality traits. Even those who are more flexible must reorient themselves, question much of their training, and their ideas about human motivation. It is easier, to believe rumors that new programs have failed than to change deep-rooted attitudes. It is important to emphasize that change requires time, education, trial and error. Edwin Land of Polaroid has pointed out, we do not treat our social research and development with the same scientific detachment and persistance we show with innovations in hardware.

No one expects the first attempt at building a complex technology, such as a new computer system, to work without adjustments and changes, trials, and errors. The memory system and central processing unit may be redesigned a number of times to fit each other. Nor does anyone expect even the best computer system to be the ultimate model. Yet, when new experiments at managerial innovation fail or are only partially successful, someone will always jump up and say, "See, it doesn't work, because people can't accept responsibility."

They fail to ask whether proper conditions for sociotechnical innovation were met, whether employees had the proper training, whether everyone understood the goals and values directing change. Studies of successful managerial innovation indicate that success depends on factors such as these, not to mention in any unionized situation the absolute importance of the union's equal role in the design, implementation and evaluation of such programs.

Another cause of resistance is lack of information. These hearings are a step in the right direction, of describing good models of managerial and sociotechnical innovation and calling attention to the economic, human, and social dangers of new technology that is poorly managed.

However, it is not easy to obtain adequate and useful data about model programs. There are some companies, such as Procter &

Gamble, which consider sociotechnical innovation to be proprietory information.

In the case of Volvo, there have been rumors that the sociotechnical innovations, begun at the Kalmar plant have been a failure and abandoned. I am glad that you will hear from Berth Jönsson of Volvo that this highly innovative approach has resulted in significant economic gains and a higher level of cooperation between the local union and management.

What should be the role of government in furthering managerial innovation? In the past, governments have stimulated and supported pilot programs. In Norway, as you will hear, Einar Thorsrud's industrial democracy project had tripartite support from government, unions, and employers. In the sixties, that project studied both the economic and human effects of different forms of participation in Germany and Yugoslavia, and helped to develop new models in Norway.

In 1973, Thorsrud advised those of us who were working with Harman Industries and the UAW at Bolivar, Tenn., on an American model of union-managment cooperation to improve work. The Bolivar project was partially supported by the National Commission on Productivity, which allowed us to study the human, social, and economic factors in depth, more than would have been possible without that kind of funding.

Because of government funding, the unions were willing to take a risk and participate in something they wouldn't have done if it had just been financed by management.

Government can play a needed role in supporting innovative new approaches as in the case of the National Science Foundation studies by social scientists. But to be useful, such research must itself be innovative. In my experience, social scientists can make themselves a nuisance by their compulsion to measure everything, including the unmeasurable. Some variables can be measured, others require more anthropological study and analysis in the form of case histories, which explore human motivation, values and industrial relations as well as technical and economic factors.

Recently, I attended a small meeting of the National Research Council to discuss methods of studying union-managment programs to improve the quality of working life. The group included representatives from unions, management, and academia. All agreed such study would be useful to gain knowledge of what works and to encourage new programs. But the group also agreed that such study is ideally part of the QWL process itself and should be designed and implemented by the participants themselves.

The role of the National Research Council could be to develop a basic evaluation instrument, including key variables and different methods of measurement. This would be made available to companies and unions with the request that they make the results available to the National Research Council for publication and use in formulating public policy.

In other words, I think we must be very careful about putting these kinds of projects and programs into the traditional framework of professional research by social scientists, which can in fact end up harming, rather than helping the process.

Two years ago, the Joint Economic Committee of Congress commissioned me to try to answer the question: Is the work ethic deteriorating in America?

A number of studies combined with my own observations indicates that values are indeed changing in America, but the work ethic is still strong. Americans increasingly object to work that does not allow them to use their brains and which robs them of their dignity. Notably, a study by the U.S. Chamber of Commerce shows that 80 percent of workers today believe they could improve productivity if management would only listen to their ideas. Workers want to learn at work and have a say in how it is carried out. Otherwise, they become resentful and cynical.

To conclude, perhaps the most important human factor affecting innovation and productivity today is leadership. In business and government, leadership can either bring out the best or the worst in people, according to how work is organized and technology is designed. There is a great risk that in the whole development of a new approach to the quality of working life, people will believe that it is just another technique that can be applied mechanically.

In describing the sociotechnical systems that further productivity and macroeconomic policies that encourage investment, we must not lose sight of the essential role of leaders at all levels of business and government and unions, who articulate and defend values that are the basis of trust, cooperation, and creative innovation.

Thank you.

Mr. LUNDINE. I thank you for giving us what I think is an excellent overview of the entire area we hope to explore in these next 6 days of hearings.

You talked about the disturbing and growing tendency to look on social science research as esoteric and unrelated to real goals. You touched on that a little bit. But I wondered if you had any advice for this subcommittee toward the development of a more effective Federal research effort in this area?

Mr. MACCOBY. My suggestion would be to use a mechanism such as the National Research Council, of the National Academy of Sciences, which bring together—social scientists—with people from unions and from business, who are in the forefront, pioneering in this kind of effort, to determine together the kind of research that would be of the most value.

Mr. LUNDINE. I couldn't help but smile and identify with your comment about social scientists always wanting to measure. I recall at home when some factories were about to go out of business, we had some social scientists come to advise us, who wanted to take baseline measurements. One irate factory owner said well, by the time you get done with your baseline measurements, we will be out of business.

Mr. MACCOBY. I will give you another illustration. In the Bolivar project we had an independent study by social scientists at the University of Michigan. They came in after the program had been going a couple of years and said, "We just surveyed the workers"—this was said to a group of workers—"and we find you don't believe you participated in managerial decisions as much as you used to."

The workers said, "How could that be? We are all participating."

The researchers said, "Well, that is your opinion. We are hard scientists, we have the data" and everybody went away feeling bad. Two weeks later the academics called and said "we just discovered we had an error in the computer program. You do believe you are participating more now than before."

Mr. **Lundine**. Beyond Government research, what do you think the Government can do to reduce resistance? You described corporate resistance, you didn't touch so strongly on union resistance, but I am sure you will agree it is evident in some cases. What do you think the Government can do to reduce, particularly corporate resistance to the sociotechnical change?

Mr. **Maccoby**. I think the Government role, one, is a hearing such as this: That is, the highlighting of good models.

One of the things that troubles me is that some of the people in business who have worked in this area in the most successful way hesitate to talk about it, either because they think it is proprietary information, or because they feel that perhaps they will be all by themselves and appear to be criticizing other companies. It is notable to me that in these hearings, there seem to be more representatives of Japanese than American companies, and I know that is not because some American companies are not just as much in the forefront of managerial innovation.

I think another thing the Government can do is to support the development and study of new models, and I don't think it should be too much and too massive support, to help create models that will not be developed or studied by the private sector alone. Particularly, I have in mind projects including unions with goals that are social and human as well as economic.

I think it is very important to take account of the comments Mrs. Heckler made of the importance of considering people's reaction to technology and the need to gain some control over it, which is not exactly the kind of goal that a business can justify. But Government, which is concerned with productivity in a much larger sense, not just in the sense of output per man hour, but in the sense of the best use of all our resources—capital, raw materials and people in the long run, can support such research through, I think either a structure such as the National Research Council or the National Science Foundation. But, I think, it must balance the pure professional control of research with this broader relationship to leaders in Government, business, and unions, who can, I think also teach the researchers a great deal.

Mr. **Lundine**. I thought you made a very excellent point about getting started with some of these joint projects, that some Government funding often will allow the union to proceed and to actually experience joint ownership of it, whereas if it is totally management funded, there is a greater degree of suspicion.

Now, I just want to follow up with one additional question about the research. We are about to hear from our friend, your colleague from Norway, Einar Thorsrud. Do you think something like his industrial democracy project here would be useful in terms of, I don't know if I would say research, but in terms of implementing the kind of sociotechnical changes that you recommend?

Mr. **Maccoby**. I could see something like that in a limited way. Of course, we learned a lot from his project. Yesterday Einar

Thorsrud and I were invited to speak to some of the top management of Amtrak. They asked us to come and talk about their problems.

Well, it was clear from all their discussion that they knew if they could involve the employees who are very eager to be involved, it would be possible to improve productivity in Amtrak significantly and make the railroads a much more going concern, which I think would be to the benefit of all of us. But they have 27 unions, and they have a management which is very traditional and fearful, like most managements are, because they don't rise to the top by working cooperatively with unions. In the past, they bought labor peace at the expense of unproductive agreements.

That is the kind of situation where perhaps a national project on productivity and quality of working life, concerned with both human and economic development could come in and play a role, because you are dealing with 27 unions. It is a very complicated, very difficult situation that is not going to be solved just by those people by themselves. That is a role where Government in a creative way, might play an absolutely crucial role.

Mr. LUNDINE. Mrs. Heckler.

Mrs. HECKLER. Thank you.

I couldn't help but think that it would have perhaps been very fortuitous if somehow the Department of Transportation had counseled with you and your colleague and involved the air traffic controllers in some kind of a participatory management scheme in which there would be some cross-fertilization of ideas and needs and concerns. And where would we be now if that had occurred?

Mr. MACCOBY. I would like to comment, Mrs. Heckler, because 3 years ago I was asked in by the FAA to comment on their attempts at sociotechnical development and change, with Professor Walton at Harvard. Both of us said why can't you work with PATCO, because if you could do this cooperatively, here is a chance to really improve the whole quality of working life as well as to make the air control system more effective. The administrators refused to talk to PATCO.

I can understand their feelings—there had been a tremendously hostile adversarial situation develop which I think no one deserves all the fault for, but had reached the point where it was impossible for them to get together with the union at a time when it still would have been possible to look at some of the issues which underlie this tragic strike, which included things like the career development of the air controller, the form of management of the air controllers, they say that the air controller has on new technology. These are the basic underlying issues which not addressed, come out in issues of money, and grievances, in an adversarial framework.

I think, as Congressman Lundine well knows from his own experience as a mayor, many times these issues which come out on the collective bargaining table never would have emerged if you could have in the beginning looked together at forms of management and possibilities of cooperation.

Mrs. HECKLER. It seems ironic that you were called in by the FAA, of all agencies of Government. There really was a need to have some exchange of views. But that raises another subject, how do you develop the right attitudes, not only on the side of management but on the side of labor leadership?

Obviously there would be a great deal of labor support, I think, among the rank and file and among high ranking senior people. However, one, the union could elect a business representative, a business agent who would be so strident that no exchange would be possible. How are you going to bring about both, the changes both on the side of management, which doesn't want to sit down with labor and discuss how things could be better, and on the side of union leadership, where, if they were involved in an exchange on management techniques and this kind of exchange could be developed, would not elect striking, radical leaders?

Mr. MACCOBY. I think what you say is very true. As one UAW vice president said to me recently, it turns out that most management get the unions they deserve, and the unions tend to be mirror images of that management. It is my experience that if change is going to take place, the management has to take the lead, and that in many cases, unions do respond.

The most dramatic example that I know is the communications workers today, with excellent leadership from Glenn Watts and other leaders in that a union who see the need, not only for cooperation and higher productivity—as the communications workers often say "We would rather bargain with A.T. & T. than with Chrysler"—they are aware they need strong companies.

But they are also aware that this is a program that will be developed in good faith cooperatively as a means to improve the quality of working life for their members. They recognize they also need to develop their own capabilities beyond the collective bargaining competencies to competencies required for teamwork, problem solving together, understanding new technology. All this requires a real development on the part of unions.

I firmly believe that while some union leaders are so entrenched and inflexible that they will never change, there are also many who if they really felt there was good faith, that companies were not trying to just get rid of them, that they would be willing to cooperate the way the CWA and UAW are.

Mrs. HECKLER. I can certainly understand your point of view because in my own congressional district I have a number of unions and find some of the union leadership is extremely advanced, supportive, enlightened, aware of the total business climate and of their stake in having a company succeed, and willing to sit down and discuss this interchange.

I think it is unfortunate in the case of Patco and with the FAA 3 years ago—really, you think of the dislocations of this whole economy which can go on for several years, the personal losses as well as the economic losses, are just staggering—that that could have been avoided by new procedures which certainly are not so new that they had not yet then been discovered. Had you been contacted, all of this could have been avoided. It seems tragic that that did not occur.

Acknowledging that barriers may also be posed by management, in terms of labor leadership, I wonder, have you had any contact with the AFL-CIO in general, and specifically, any which show any willingness on their part to develop this kind of rapport within many industries which their umbrella organization encompasses?

Mr. **Maccoby**. I have talked to many officials of the AFL-CIO and expect to more in the coming weeks. I think the viewpoint emerging, stated particularly by Tom Donahue as secretary-treasurer of AFL-CIO, is that the unions are willing to participate in a process that is cooperative as long as it is clear the companies really are accepting their role, in a limited partnership.

I think some union leaders understand that unless they get involved in this kind of process, unless they develop the capacity to appeal to the new kind of worker with new values and new competencies, that unions themselves are not going to be able to organize and to remain strong. So they see it in their own self-interest as well as in the interest of their members and interest of the economy as a whole, that it is necessary to move in this direction.

Mrs. **Heckler**. Just one other point. Regarding your discussion of the social scientists and their limitations or penchant for measurement, what do you think is the desirable role of social scientists in this general process?

Mr. **Maccoby**. I think the key role of social scientists—when you hear from Einar Thorsrud you have a great example of that role in practice—is somebody who comes in and helps people learn to be social scientists themselves. In other words, it is in a way like a good doctor who doesn't just treat somebody and make them feel like they are children or machines, but comes in and helps them learn how to take care of their own health and live in a better way.

A good social scientist comes in and brings his or her own background, expertise, understanding, into the process as a coworker in a way that the social scientists is also learning with the other participants. The social scientist knows certain things and has certain skills of measurement or interpretation or understanding, but his goal is also to develop the capacity for those workers, those managers, those union leaders to be able to study, evaluate, understand, do social science. In a sense it is democratization of social science.

That is very much the view that the great Swiss psychologist, Jean Piaget has described in teaching science and mathematics. There is a beautiful book he wrote for UNESCO called "To Understand is to Invent," in which he points out that the role of a good science teacher is not to lecture at students and make them memorize solutions, but to set up for them questions and then have them try out alternative solutions and help them learn how to critically evaluate solutions to those problems and questions.

I think that is exactly what we see that a good social scientist does in helping to develop managerial innovation and social-technical innovation.

Mrs. **Heckler**. Thank you very much.

Mr. **Lundine**. Before recognizing Mr. Brown, you might like to note it happens we have Bill Koch, I guess, from the FAA scheduled as part of these hearings next week.

Also, we have Lloyd McBride, president of the United Steel Workers who, I think, is a fairly typical and large AFL-CIO union. We are looking forward to their testimony as well.

Mr. Brown.

Mr. **Brown**. Dr. Maccoby, I am interested in trying to set the current concern with quality of life in the workplace in some sort of historical context.

I would like to have you evaluate briefly for me, if you could, just how we stand in terms of interest, concern, energy, effort, and resources devoted to this in comparison with the past.

I am sure you are well aware of the history of interest in how to improve productivity. There is a literature going back at least 50 years in this field.

There are eminent researchers, many of them at Harvard, who have written extensively on this over the years. You have psychologists such as Piaget whom you mentioned, Fromm, and many others who have discussed this in great detail.

I am wondering, are we in some sort of cycle at which certain times we get interested and other times we forget? Are we making progress in creating understanding of this?

We seem to forget that many of the very interesting Japanese developments are borrowed from past generations of American thinking, reflecting concerns from 10 to 30 years ago, at least.

How do we get this on track to become a significant part of our thinking in the light of this history of concern?

Mr. **Maccoby**. Mr. Brown, I think that is a very apt comment and question. It is, of course, true that there is a history of attempts to improve productivity and the quality of working life, starting in the 20th century with Frederick Winslow Taylor and the development of scientific management which had its positive aspects in terms of production and its negative aspects in terms of making work more mechanistic and so on, that since then there have been many attempts to try to humanize work, improve work.

The most notable, as you refer to was the Harvard researchers in the Hawthorne factory of Western Electric in the late 1920's and early 1930's which showed very clearly that worker participation raised productivity.

However, what happened was there was a depression, there were layoffs, there was no union. The workers just stopped participating. They wouldn't participate because their rights weren't protected.

We had successful results in the Second World War with union management committees in many factories. That all fell apart after the war as people began to struggle over wages and power and so on. Rather than give up managerial control, companies raised wages.

I think the difference today is that we have taken a lot of these lessons and applied them.

I think the difference is today that we have learned that there are certain conditions that have to be met to achieve cooperation. For example, the union role. For example, the articulation of values decisionmaking structures, and training, are required to make this approach work. That is one thing.

The second thing that is a difference is that American industry is now in a very competitive situation. It is no longer the case as it was after the war where we practically controlled world business and had no real competition.

I think the difference today is, unless we develop our human resources in the way Congressman Lundine has mentioned, that American industry will not be able to compete.

Mr. **Brown**. Do you think that this necessity is going to produce, then, a permanent commitment to the recognition of the value of treating human beings as human beings, and involving them in the work force, or is it just going to last only until we again achieve, we will say, competitive success or something of that sort?

Mr. **Maccoby**. Well, that is exactly the question. Of course, I don't thik anybody can answer that question. Even though an approach proves rational, that doesn't mean that people will adopt it. Human beings are not that rational, especially when they feel frightened and threatened.

Second of all, it can very well be that they adopt a better approach only so long as there is a crisis. I think the answer to your question depends on the quality of the leadership in this country.

That is why hearings like this are so important. Unless Congress shows the understanding, the leadership to go beyond simple views of macroeconomics and supply-side theories, to understand the need for managerial development and the need for a much higher level of understanding of people and their needs and capacities, then it is very likely that we will fail to improve productivity, competitiveness, and the quality of working life.

There is no guarantee that we are going to adopt things just because they are good.

Mr. **Brown**. Well, it is rather interesting that work of this sort is going on in many parts of the world, and we are fortunate that these hearings will allow us to understand that.

In Japan, Norway, Germany, Yugoslavia, and I am sure, Russia and China, we would find similar efforts going on. I think perhaps what we need to do is recognize that this is only part of a total effort to improve not just the quality of working life, but the quality of human existence in the world.

Because the working environment constitutes the major environment of human beings, it is vital that we should play the role which our history and resources and status in the world demands that we play, instead of lagging behind the rest of the world.

Is that a statement you could agree with?

Mr. **Maccoby**. I would agree with it fully and add something: Einar Thorsrud helped to bring to Toronto last week 2 of the leaders of Solidarity from Poland; a union president from the shipbuilding works in Gdansk—70,000 shipbuilders—and a union leader from the steelworks in Krakow. Both of them wanted to learn from us how to develop the quality of working life, to go beyond the kind of bureaucratic rigid approach to the workplace that exists in the Communist world, which is really far worse than the quality of work life that we have.

We have an opportunity, I believe, if we can build on the best that we have, and it is there, to be leaders in the world and to go beyond, I think, also the Japanese approach, which is based on a traditional society of the group before the individual, to an approach which is based on our best values, of individual rights and voluntary cooperation.

That is a very powerful basis, if we can get that together, to create an economy that is concerned with both human beings and productivity.

Mr. BROWN. Thank you.

Mr. LUNDINE. I would like to welcome again and express my thanks directly to Chairman Walgren. Would you like to inquire?

Mr. WALGREN. Well, perhaps not to inquire so much, but to say that I think this series of hearings may certainly be the most important topic that this subcommittee has tried to develop.

I appreciate both the interest of the witnesses in coming, and particularly the specific interest of Mr. Lundine in this area.

I don't think anything else that I have seen has more implications for stronger economic life in this country. One of the saddest revelations I have had since becoming chairman of this particular subcommittee was to see the Reagan administration "turn its back" on human factors with respect to the National Science Foundation.

It is almost as if the administration wishes that all these things could be reduced to dollars and cents, and that the only motivator we have is some kind of discipline from a balance sheet, or that workers themselves are only motivated by dollars alone.

That seems to me to be obviously shortsighted. I hope that the 6 days of hearings devoted to this subcommittee's interest, will stimulate a broadening of thought in that area.

I am curious, Dr. Maccoby, Mr. Brown noted the cyclical nature of how we seem to relearn the experiences of the past.

You indicate that we seem to have made strides, and then slipped in the post-World War II era, when, I gather, there was prosperity, and then we made strides and then slipped in the recession era, when I gather there were hard times.

If we slip in both prosperity and recession, how do you maintain the momentum of success?

Mr. MACCOBY. I think, Mr. Walgren, that while there has been slippage at these times, it is also fair to say that we have learned something from each period. That there is a difference.

For example, in the past, in the Elton Mayo, Roethilsberger research that led to a whole industrial human relations movement, that was still within a paternalistic framework of management and the workers.

Today, in the General Motors, UAW, or A.T. & T. Communications Workers' approach, they are no longer within that framework, they are in a framework of union-management equality which establishes a much firmer basis for trust and cooperation.

The process doesn't depend on the good will of a particular manager. It becomes something rooted in the organization, the institutions. Training programs are established, and union leaders themselves develop new competencies to take part in this kind of productive, innovative management.

So I think that it is true that sometimes history is not a simple linear progression and that good things get lost. It is also true that some people have learned a great deal.

Mr. WALGREN. Would it also be true that one of the elements of failure has been in the union goals, when, it has sometimes been argued, that goal has been the pursual of dollars alone?

I am thinking of the United Mineworkers during the war where, essentially in response to pressure by automation, they said, "Just give us lots of dollars and we will forget about the impact of automation."

In some other instances, it seems to me that bargaining has been focused on the dollars alone, without regard to participation or other factors.

Looking back on the last 20 years of the union movement, can you see a way that they could have redirected our sights and their sights constructively?

Mr. MACCOBY. Well, I think your point is well taken. But I think we must recognize that, in the past, people have moved up to union leadership because of their ability at the traditional collective-bargaining competences, to gain money and material benefits for union members.

They haven't really understood technology or management. They have said, "we will let you do the managing and we will get our share of the pie." It is only recently that unions like UAW or Communication Workers have realized that this is not sufficient.

First of all, the pie isn't going to be growing without a different kind of management and union cooperation.

And second, they have to understand technology at a very early stage, understand its effects and how to deal with it.

We have learned a great deal from the Scandinavians. They were the first to show that you could, in a participatory way, redesign productive technology.

Einar Thorsrud will talk about how this works in ship design. Berth Jönsson of Volvo will talk about the redesign of the assembly line. But I don't think anybody, until the early 1970's, understood that.

Now the burden is on the unions to develop new competency in understanding technology and management, I believe, if they are going to survive as a force for the future, even in terms of their ability to organize workers.

But I do think what we are learning from General Motors and A.T. & T. is that when unions are willing to put that investment in and learn these new competencies, it is better for the firm as a whole.

It leads to a more productive involved committed work force which is also more flexible about job classifications and new technology, rather than the old style you are talking about, still true on the railroads, for example, which sees its role as defending high wages and rigid classifications, as the business hovers at the brink of failure.

Mr. WALGREN. Then can you see the same kind of deficiency in management's approach to their enterprise in that they, too, have managed using dollars on computer printout sheets alone, often failing to take the broader view of their contribution to the whole.

Mr. MACCOBY. Quite correct. We see on the top level a need for quick results, and financial gain, often of a chief executive who has a very short tenure and has to show quick results rather than long-term development in contrast to companies like Hewlett Packard, where they have the owner entrepreneur can take the longer view.

On lower levels, management in big companies often have incentives in such a way that they gain personally at the cost of the whole company. I have seen this a number of times, where if a person in one department meets budget by not providing new technology to the operations side, he gets a raise, but the company doesn't gain revenue and can't compete.

Mr. WALGREN. One final thought. Have you or someone else ever been able to look at or has someone looked at closely the hindrance that government is to management? And particularly, perhaps an unwarranted hindrance?

It strikes me that when we call for such citizen participation by management as we do, in our political system, we say that, "It is really your responsibility." As a Congressman, I have said it many times. "You know, you are the ones that have to keep us headed on the right track." And then they, in pursuit of that responsibility as citizens, expend so much energy tilting in a sense perhaps at windmills that may be particularly bothersome like a burr under the saddle, they miss what is really troubling the enterprise at the bottom.

Has anybody tried to evaluate whether or not we are distracting our management by asking them to play a large political and citizenship role, so that they are not looking at the real problems?

Mr. MACCOBY. At the conference that the Commerce Department and OPM sponsored on the frontiers of management 2 years ago we brought together some of the companies that are in the forefront of managerial development such as GM, A.T. & T., Cummins Engine, Procter & Gamble, and asked them their views on that kind of question.

One of the things that came out is that there is no way that the regulations can take account of the difference between companies which really are principled and of good faith and are willing to work cooperatively to move in a positive direction in terms of the environment and health and safety, and those which are really trying to get away with something.

We don't make distinctions between those that Government can work with cooperatively which are trying to move in that direction. For those companies, the regulations may just become bureaucratic hinderances to creative development. However, without these regulations, many companies would fail to act.

Mr. WALGREN. Thank you very much. Thank you, Mr. Chairman.

Mr. LUNDINE. Thank you, Mr. Maccoby, very much.

Now I would like to welcome Einar Thorsrud, whom I consider probably the world's greatest expert in this area. He has been chairman of the International Council for the Quality of Working Life since 1974, and director of the Work Research Institute at Oslo, Norway.

I was just looking over his biography. There is a list, about half a page, of his publications, only in English. I don't know how many additional publications in Norwegian he has. In welcoming you, I would like to say that I think that your straightforwardness and your ability to relate to workers and Congressmen alike is most appreciated.

I really am delighted that you have been able to schedule an appearance before the subcommittee and look forward to your testimony. Welcome.

[The biographical sketch of Mr. Thorsrud follows:]

Curriculum vitae -- Einar Thorsrud

Born 1923 and graduated as a psychologist from the University of Oslo, 1948.

Specialized in social and organizational psychology.

Personnel work in public administration and industry, 1949-54.

Associate professor of psychology and director of Institute for Industrial Social Research, Trondheim 1958-65.

Director of the Industrial Democracy Programme in Norway, 1962-72.

From 1965 Director of Work Research Institute, Oslo. At present research director (shipping project) at the same Institute and professor of social psychology, University of Oslo.

Chairman of the International Council for the Quality of Working Life, 1974-81.

Advisor to I.L.O., O.E.C.D. and other international organizations and the government of Jamaica, on industrial and educational development projects.

Visiting professor University of California, Los Angeles, University of Glasgow, and other academic institutions, teaching organization theory and advising on action research.

Has published a large number of articles and books in Norwegian. Some publications in English:

Thorsrud, E. and Emergy, F.E.: Form and Content in Industrial Democracy. Tavistock Publ, London 1969.

Thorsrud, E. and Emergy, F.E.; Democracy at Work. Nijhoff Publ., Leiden 1976.

Thorsrud, E.: Democracy at Work: Norwegian Experiences with Nonbureaucratic Forms of Organization. In: The Journal of Applied Behavioural Science, Vol. 13, No. 3, 1977.

Thorsrud, E.: Perspectives on the Quality of Working Life in Scandanavia. ILO, Geneve 1977.

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Thorsrud, E.: The changing structure of work organizations. In Kanawaty (ed) Managing and developing new forms of work organization. I.L.O. Geneva 1980.

Thorsrud, E.: (with Kanawaty, Semiono and Singh) Field experiences with new forms of work organization, Intern. Lab. Rew. No. 3, 1981.

STATEMENT OF EINAR THORSRUD, WORK RESEARCH INSTITUTE, NORWAY

Mr. THORSRUD. I would like to say I am not only honored by being given this chance to give testimony to a Congress committee, but it is very interesting for me because this special kind of hearing is not part of our political system.

We are discussing just now perhaps trying something similar. It is only by being directly involved that I get a certain chance to understand what it really is. Just like being involved in the new forms of work organizations which I will discuss with you.

Mr. LUNDINE. I understand you want to summarize. Proceed as you like. But your entire statement that has been provided in writing will be made a part of the record.

Mr. THORSRUD. I think it is important to realize that much of what we have learned in the type of projects I will discuss come from crossing the borderlines between manufacturing industry, shipping, the public sector and education.

You can't do much with any one of these sectors unless the others are involved.

I think that it is very important also to note that we have started to work more lately with local communities because these are the ones who are really affected immediately when basic changes appear. We have overlooked for some time the ground that the local communities actually represent in creating the conditions from where new growth can come, both in education and the work sphere.

[The following is the full text from which the summary was made.]

Most of the studies I refer to have been conducted by the Work Research Institute which is Government financed but can also take on projects financed by enterprises, unions, and research foundations. The Institute is lead by a board representing Government, unions, and employers. The opinions expressed in this paper on the organization and financing of research are based on my source on the two main boards for general and technological sciences in Norway and from advisory activities in international organizations.

Science and technology seem to present quite different problems and possibilities in countries on different levels of economic development and with different political systems. More and more I have come to the conclusion that this is not the case. The methods and the results of scientific research are not defined by national boundaries. The principles of managing research where the human factor is important are of a general nature, although cultural differences will of course have to be taken into account, in the planning of research as well as in the interpretation of results. Most scientific research does not suffer from being conducted under the influence of the rapidly changing social and economic realities of society outside the research establishment. Research needs to maintain very direct, collaborative relationships with real life situations, to insure that previous knowledge is still relevant under the new conditions, and even more to stimulate new thinking, new approaches and new results relevant to the futures we are already living in.

Small countries are forced by the power situation in which they exist to be alert to basic changes in their environment. We rely on our adaptability and learning capability rather than our power or influence on others. Therefore it was quite natural for labor and industrial leaders in Norway in 1960-61 to ask themselves the following basic questions:

What will be the basis for our existence as a country with a specific culture when our natural resources no longer will give us any main advantages? The woods and the rivers, the sea and the metals were playing a decreasing role for our standard of living. This was before we struck oil in the North Sea.

What will the situation be when Norway faces an increasingly international market with worldwide competition and worldwide access to new technology?

What needs to be done, on the basis of a high standard of living and a good welfare system created since the thirties, to increase the creativity and involvement of people in deciding their own future? In other words how to broaden the base for democracy and human development. There were clear signs, particularly among young workers that they wanted something more out of work than money and safe employment.

This was the basis for the so-called industrial democracy project, sponsored jointly by labor and management and later, by government. In phase A of the project—1962-64—we explored the value of representation of workers on the boards of companies. In phase B—1964-72—we conducted a series of demonstration projects to enhance the development of people and their performance by increasing their control over their own work situations. Today the projects might be called Quality of Work Life projects. The main outcome of these projects can be summarized as follows: First that board representation would not—under existing conditions with 60 to 80 percent of workers organized in trade unions—significantly increase the incluence of the rank and file on decisions affecting their future. The main reason was that there would be considerable problems for the representatives to maintain sufficient two-way contact with their electorate. And if the representatives started to promote the interests of special groups on board level, other groups would do the same, and this might in turn seriously reduce the ability of the board to act on behalf of the enterprise as a whole. We found that special ownership groups in many cases reduced the effectiveness of the board in this way.

Ten years later—1973—a law was passed to give workers representation on board level. The reason for this was partly that political parties wanted to express their interest in increasing the influence of employees in industrial life. A new law is a quick, but not necessarily an effective way of demonstrating this interest. A followup study shows that management as well as employees are rather satisfied with the new board arrangements. The functioning of the boards has not deteriorated. On the contrary it has in many cases improved, but the influence of the rank and file worker has not been significantly increased.

A second set of results, regarding the improved conditions for personal participation in every day work life decisions, in planning and in job and organizational design, showed considerable gains for workers as well as the enterprises. In very few cases workers did not prefer the new work situations where they assumed greater responsibility, increased variation and a better chance to learn on the job and help each other. Absenteeism and employee turnover decreased and productivity measured on departmental level went up. The redefinition of productivity from simple measures of worker output per hour to overall effectiveness of productive units was an important result.

Structural changes in work organizations were undertaken to replace hierarchical, bureaucratic or what we now call uniform types of organization. For example: the introduction of self-managing—or partly autonomous—groups, overlapping work roles—in what is called matrix organization—horizontal and vertical rotation between jobs and new forms of decentralized planning, coordination and control of quality and cost. All these new forms were used in different combinations to suit local needs, particularly when new technology was involved.

A third type of results, regarding diffusion of new forms of work organization showed that direct transfer from one enterprise to another or one branch to another is difficult, at least as long as the new forms are not fairly well known and accepted in general by management and unions. Copying or any form of mechanical replication will not work. In many cases diffusion from one culture to another opens new possibilities of learning. When people cross cultural boundaries to find solutions to specific problems they are often more capable of perceiving and learning new forms of social organization.

A fourth type of experience in developing new forms of work organization is based on a new law on work environment—1977. This new law did not only set new physical standards but included also psychosocial factors. And most important, it constitutes the rights of workers and their specially trained shop stewards to be personally involved in defining what is a good and safe workplace and how it can be improved. This has turned out to become a major basis for development and diffusion of new forms of work organization in Norway at present. A new type of basic labor-management agreement on the introduction of new information technology has had a similar effect.

How Norway tries to meet the challenge of new technology and at the same time accept the new social responsibilities of enterprises is perhaps best illustrated in a long term research and development program in the Norwegian merchant navy.

CHANGES IN TECHNOLOGY AND SOCIAL SYSTEMS IN THE MERCHANT NAVY

In the late sixties with some 45,000 seamen on Norwegian ships engaged in an unstable international market, recruitment was starting to be a serious problem and there was tension and high turnover in ships because of the hierarchical organization. Most young people had received 2 or more years of education and with full employment ashore a career at sea did not attract the number and the quality of people needed. This was particularly bad for an industry where everybody starts at the bottom. The isolation from normal community life and the rigid status system with closed careers at sea was not what young people were looking for. It was a time when they listened to a message and believed "the times they are a-changing." (Dylan 1963.)

With no subsidy or national protection of its merchant navy, Norwegian shipping has since the turn of the century been at the leading edge of sea transport technology. It has also been very sensitive to emerging changes in world transport of goods, the terms of trade and investment. By the end of the sixties several basic changes were foreseen. The volume of world transport open to international competition could shrink because of expansion of the Soviet fleet and that of some developing countries. At least the latter would lend their flags to ships sailing under convenient tax and mooring arrangements. New technology, in the form of very large carriers with partly automated engine rooms and highly developed information technology were already sailing. To man these ships and sail them safely and effectively would demand high quality personnel with continuously new knowledge and skills.

Pilot studies in some ships revealed a potential vicious circle where technological change and the educational system reinforced social fragmentation and lack of personal involvement in work and life at sea. To change this vicious circle into a learning process leading to structual changes has been the ambitious objective of a research and development programme which has lasted some 15 years. Some of the basic changes involved are shown in the following two figures. (See p. 36 of prepared statement.)

Mr. THORSRUD. A number of projects—and experimental ships started to increase learning on board, partly through integration of deck and engine departments, partly through decentralized work planning and control. At the same time some changes started to take place in the education of seamen. Particularly important was the development of a new role, the ship mechanic, which gradually becomes the recruitment base for both deck and engine departments. During the seventies the design of ships also changed, partly in the sense that centrally controlled automated ships was dropped as a general solution. Partly in the form of a physical layout which enhances open social interaction during work, mealtimes, and leisure time. The private sphere is protected in a new standard for cabins.

During the seventies also some overall structure changes took place, to some extent under the pressure of the worldwide shipping crisis. A new manning and service contract has been established which has reduced the size of crew and as a compensation shortening the time at sea in a permanent type of employment. New regulations have been introduced to improve safety and the work environment and seamen have got the right to be represented on the boards of their companies.

Not all of this has come as a result of the research program, but most of the new ideas have been tested out in project ships and the consequences have been studied by our institute. The basic organizational change can be seen as a gradual shift from what we have called a uniform type to multiform; one, from monorole system, where everyone fills one, and only one role, for example as a mate, a master and so forth to a multirole system, where most members fill at least one secondary role besides the primary one—sometimes in a group system, sometimes in a matrix system; two, from a segmented departmental system, where for example, deck and engine are sharply divided to a partly integrated system where members can alternate to some degree when needed; three, from unstable, high turnover employment to permanent employment with limited turnover; four, from closed careers with linear promotion to relatively open careers at sea and between sea and land; five, from hierarchical information and control to shifting patterns according to needs; six, from office based control system—budgeting, planning et cetera—to decentralized, partly ship based control; seven, from segmented and status based living quarters to integrated 24-hour society with private areas; eight, from segmentation of workplaces, schools, and research to combined work, education, and development activity; and nine, from low degree of participation in decisionmaking to high degree of participation and control over one's own work situation.

What are the major lessons to be learned from the shipping projects: First that a challenge from outside can significantly improve the willingness and ability of management and unions to initiate and support a change in policies and practices even in a tradition bound industry. Japan represents today such a challenge from outside to the industry in the rest of the world. To copy Japanese solutions will not work. We have to explore our own capabilities and possibilities and choose our own way according to the values we stand for.

A second lesson from the shipping projects is that researchers have a lot to learn, and employees on all levels can join in this learning, when new technology is tried out and evaluated in a stepwise development process in the concrete workplace setting. It is only in such a process of participation that technological choice can be made with reasonable control over the consequences—economic as well as social consequences. In the early phase this collaborative process concentrated on rather simple improvements; for example, in cleaning and painting of ship surface. Gradually much more sophisticated problems were solved. Today it is common practice to have seamen from different levels of crew to join project groups for some months or even years when new ships are designed and built.

A third lesson is that the segmentation of scientific disciplines and professions is a serious constraint in technological and social changes. It can be overcome when members of research teams coming from different disciplines are made jointly responsible, together with employees in enterprises, for the evaluation and utilization of results. The separation of schools from the world of work offers a similar problem. The integration of maritime education into the shipping change program has now been achieved by involving the schools directly in the early phases of new shipping projects. If investments for social change projects are granted to discipline oriented institutes one should not expect great return. Such investments tend to help already closed institutions and professions to maintain their privileged roles and their lack of involvement in social change. In real life change projects the distinction between basic or fundamental research and applied or action oriented research is artificial. Good applied or action oriented research must include phases of improvements in theory and method, and is in this way dependent on basic research.

Formulation or research policy and allocation of research resources cannot be based primarily on decisions in representative committees. Steering committees can play a useful role in development projects. A major force in science policymaking can come from scientific institutions themselves when they share their research tasks with those directly affected. When they share the evaluation and dissemination of results with organizations directly involved. Such a democratization of the research and development process is particularly important when choice of new technology and choice of new organizational forms is involved.

Finally a word on new technology and unemployment.

New forms of organization and introduction of new technology in the Norwegian merchant navy has reduced the standard number of crew on each ship. The total number of seamen has also been reduced without increasing the unemployment ashore. The unemployment is still below 2 percent. The reason for this is that seamen have become increasingly competent to handle new forms of work in new forms of organization. Consequently they have been prepared to move to new forms of employment and in many cases create new employment for themselves and others. Another reason has been that the school system has been involved and to some extent been changing simultaneously with the changes in technology and work organization. It is my firm belief that the unemployment problems we are facing today is only a beginning of a total redefinition of the meaning of work and of employment. A total reallocation of creative human activity between different sectors of society is needed to cope both with unemployment and with other social problems which will not be solved by turning new masses of professionals into the labor market. To improve the competitiveness of the individual firm by introduction of the latest forms of technology is also a far-too-limited approach. What we need to do is to make choice of technology and relevant forms of organization within a framework of policy based on participation more than on competition. This applies to the level of companies and local communities as well as the society at large.

Thank you.

[The prepared statement of Einar Thorsrud follows:]

TESTIMONY OF EINAR THORSRUD

(WORK RESEARCH INSTITUTE, OLSO, NORWAY)

The main background for this testimony is a series of research and development projects in Norwegian industry, shipping and education. The objectives have been to find better ways of utilizing human resources and technology to improve the quality of work and life of employees as well as the overall effectiveness of organizations where work is done. More and more we have also included in our studies the local communities. They are directly affected by the way work places are organized. In turn they represent the immediate environment from which initiatives and commitment can come for further development of creative human activities inside enterprises as well as outside.

Most of the studies I refer to have been conducted by the Work Research Institute which is government financed but can also take on projects financed by enterprises, unions, and research foundations. The Institute is lead by a board representing government, unions, and employers. The opinions expressed in this paper on the organization and financing of research are based on my source on the two main boards for general and technological sciences in Norway and from advisory activities in international organizations.

Science and technology seem to present quite different problems and possibilities in countries on different levels of economic development and with different political systems. More and more I have come to the conclusion that this is not the case. The methods and the results of scientific research are not defined by national boundaries. The principles of managing research where the human factor is important are of a general nature, although cultural differences will of course have to be taken into account, in the planning of research as well as in the interpretation of results. Most scientific research does not suffer from being conducted under the influence of the rapidly changing social and economic realities of society outside the research establishment. Research needs to maintain very direct, collaborative relationships with real life situations, to insure that previous knowledge is still relevant under the new conditions, and even more to stimulate new thinking, new approaches and new results relevant to the futures we are already living in.

Small countries are forced by the power situation in which they exist to be alert to basic changes in their environment. We rely on our adaptability and learning capability rather than our power or influence on others. Therefore it was quite natural for labour and industrial leaders in Norway in 1960-61 to ask themselves the following basic questions:

(I) What will be the basis for our existance as a country with a specific culture when our natural resources no longer will give us any main advantages? The woods and the rivers, the sea and the metals were playing a decreasing role for our standard of living. (This was before we struck oil in the North Sea).

(II) What will the situation be when Norway faces an increasingly international market with world wide competition and worldwide access to new technology?

(III) What needs to be done, on the basis of a high standard of living and a good welfare system created since the 1930's, to increase the creativity and involvement of people in deciding their own future? In other words how to broaden the base for democracy and human development. There were clear signs, particularly among young workers that they wanted something more out of work than money and safe employment.

This was the basis for the so-called Industrial Democracy Project, sponsored jointly by labour and management and later, by government. In phase A of the project (1962-64) we explored the value of representation of workers on the boards of companies. In phase B (1964-72) we conducted a series of demonstration projects to enhance the development of people and their performance by increasing their control over their own work situations. (Today the projects might be called Quality of Work Life projects.) The main outcome of these projects can be summarized as follows: First that board representation would not (under existing conditions with 60-80% of workers organized in trade unions) significantly increase the incluence of the rank and file on decisions affecting their future. The main reason was that there would be considerable problems for the representatives to maintain sufficient two way contact with their electorate. And if the representatives started to promote the interests of special groups on board level, other groups would do the same, and this might in turn seriously reduce the ability of the board to act on behalf of the enterprise as a whole. (We found that special ownership groups in many cases reduced the effectiveness of the board in this way)

Ten years later (1973) a law was passed to give workers representation on board level. The reason for this was partly that political parties wanted to express their interest in increasing the influence of employees in industrial life. A new law is a quick, but not necessarily an effective way of demonstrating this interest. A follow up study shows that management as well as employees are rather satisfied with the new board arrangements. The functioning of the boards has not deteriorated. On the contrary it has in many cases improved, but the influence of the rank and file worker has not been significantly increased.

A second set of results, regarding the improved conditions for personal participation in every day work life decisions, in planning and in job and organizational design, showed considerable gains for workers as well as the enterprises. In very few cases workers did not prefer the new work situations where they assumed greater responsibility, increased variation and a better chance to learn on the job and help each other. Absenteeism and employee turnover decreased and productivity measured on departmental level went up. The re-definition of productivity from simple measures of worker output per hour to overall effectiveness of productive units was an important result.

Structural changes in work organizations were undertaken to replace hierarchical, bureaucratic or what we now call "uniform" types of organization. E.g. the introduction of self managing (or partly autonomous) groups, overlapping work roles (in what is called matrix organization) horizontal and vertical rotation between jobs and new forms of decentralized planning, coordination and control of quality and cost. All these new forms were used in different combinations to suit local needs, particularly when new technology was involved.

A third type of results, regarding diffusion of new forms of work organization showed that direct transfer from one enterprise to another or one branch to another is difficult, at least as long as the new forms are not fairly well known and accepted in general by management and unions. Copying or any form of mechanical replication will not work. In many cases diffusion from one culture to another opens new possibilities of learning. When people cross cultural boundaries to find solutions to specific problems they are often more capable of perceiving and learning new forms of social organization.

A fourth type of experience in developing new forms of work organization is based on a new law on work environment (1977). This new law did not only set new physical standards but included also psycho-social factors. And most important, it constitutes the rights of workers and their specially trained shop stewards to be personally involved in defining what is a good and safe workplace and how it can be improved. This has turned out to become a major basis for development and diffusion of new forms of work organization in Norway at present. A new type of basic labour-management agreement on the introduction of new information technology has had a similar effect.

How Norway tries to meet the challenge of new technology and at the same time accept the new social responsibilities of enterprises is perhaps best illustrated in a long term research and development program in the Norwegian Merchant Navy.

Changes in Technology and Social Systems in the Merchant Navy

In the late 60's with some 45,000 seamen on Norwegian ships engaged in an unstable international market, recruitment was starting to be a serious problem and there was tension and high turnover in ships because of the hierarchical organization. Most young people had received two or more years of education and with full employment ashore a career at sea did not attract the number and the quality of people needed. This was particularly bad for an industry where everybody starts at the bottom. The isolation from normal community life and the rigid status system with closed careers at sea was not what young people were looking for. It was a time when they listened to a message and believed "the times they are a-changing". (Dylan 1963).

With no subsidy or national protection of its merchant navy, Norwegian shipping has since the turn of the century been at the leading edge of sea transport technology. It has also been very sensitive to emerging changes in world transport of goods, the terms of trade and investment. By the end of the 1960's several basic changes were foreseen. The volume of world transport open to international competition could shrink because of expansion of the Soviet fleet and that of some developing countries. (At least the latter would lend their flags to ships sailing under convenient tax and mouring arrangements). New technology, in the form of very large carriers with partly automated engine rooms and highly devleoped information technology were already sailing. To man these ships and sail them safely and effectively would demand high quality personnel with continuously new knowledge and skills.

Pilot studies in some ships revealed a potential vicious circle where technological change and the educational system reinforced social fragmentation and lack of personal involvement in work and life at sea. To change this vicious circle into a learning process leading to structural changes has been the ambitious objective of a research and development programme which has lasted some fifteen years. Some of the basic changes involved are shown in the following two figures.

Figure 1. Reduced learning and autonomy in ships, increased social distance and mobility

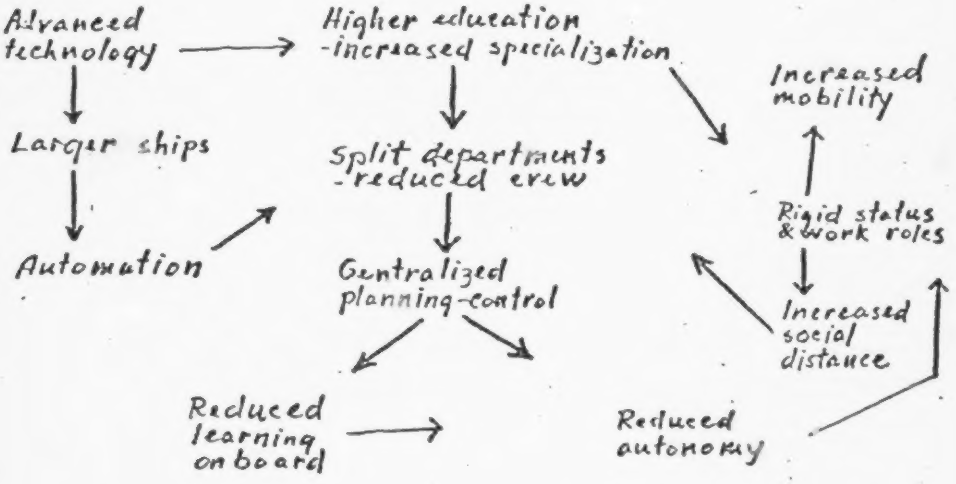
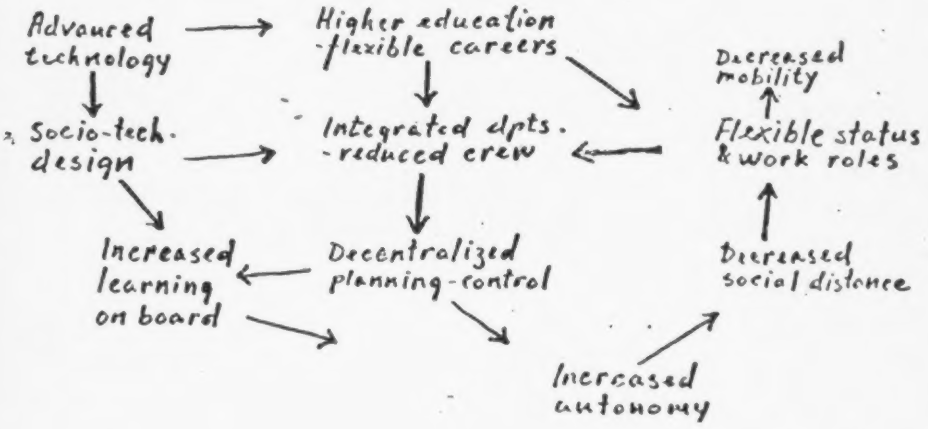

Advanced technology
Higher education -increased specialization
Increased mobility
Larger ships
Split departments -reduced crew
Rigid status & work roles
Automation
Centralized planning-control
Increased social distance
Reduced learning on board
Reduced autonomy

Figure 2 A learning and development process increasing involvement and autonomy


Advanced technology
Higher education -flexible careers
Decreased mobility
Socio-tech. design
Integrated dpts. -reduced crew
Flexible status & work roles
Increased learning on board
Decentralized planning-control
Decreased social distance
Increased autonomy

A number of projects, and experimental ships, started to increase learning on board, partly through integration of deck and engine departments, partly through decentralized work planning and control. At the same time some changes started to take place in the education of seamen. Particularly important was the development of a new role, the ship mechanic, which gradually becomes the recruitment base for both deck and engine departments. During the 70's the design of ships also changed, partly in the sense that centrally controlled automated ships was dropped as a general solution. Partly in the form of a physical layout which enhances open social interaction during work, mealtimes and leisure time. The private sphere is protected in a new standard for cabins.

During the seventies also some overall structure changes took place, to some extent under the pressure of the world wide shipping crisis. A new manning and service contract has been established which has reduced the size of crew and as a compensation shortening the time at sea in a permanent type of employment. New regulations have been introduced to improve safety and the work environment and seamen have got the right to be represented on the boards of their companies.

Not all of this has come as a result of the research programme, but most of the new ideas have been tested out in project ships and the consequences have been studied by our institute. The basic organizational change can be seen as a gradual shift from what we have called a uniform type to multiform;

(i) From; mono-role system, where everyone fills one, and only one role, e.g. as a mate, a master etc.
To; multi-role system, where most members fill at least one secondary role basides the primary one. (Sometimes in a group system, sometimes in a matrix system.

(ii) From a segmented departmental system, where e.g. deck and engine are sharply divided.
To a partly integrated system where members can alternate to some degree when needed.

(iii) From unstable, high turnover employment.
To permanent employment with limited turnover.

(iv) From closed careers with linear promotion.
To relatively open careers at sea and between sea and land

(v) From hierarchical information and control.
To shifting patterns according to needs.

(vi) From office based control system (budgetting, planning etc).
To decentralized, partly ship based control.

(vii) From segmented and status based living quarters.
To integrated 24 hour society with private areas.

(viii) From segmentation of workplaces, schools and research.
To combined work, education and development activity.

(ix) From low degree of participation in decision making.
To high degree of participation and control over ones own work situation.

What are the major lessons to be learned from the shipping projects: First that a challenge from outside can significantly improve the willingness and ability of management and unions to initiate and support a change in policies and practices even in a tradition bound industry. Japan represents today such a challenge from outside to the industry in the rest of the world. To copy Japanese solutions will not work. We have to explore our own capabilities and possibilities and choose our own way according to the values we stand for.

A second lesson from the shipping projects is that researchers have a lot to learn, and employees on all levels can join in this learning, when new technology is tried out and evaluated in a stepwise development process in the concrete workplace setting. It is only in such a process of participation that technological choice can be made with reasonable control over the consequences, -- economic as well as social consequences. In the early phase this collaborative process concentrated on rather simple improvements e.g. in cleaning and painting of ship surface. Gradually much more sophisticated problems were solved. Today it is common practice to have seamen from different levels of crew to join project groups for some months or even years when new ships are designed and built.

A third lesson is that the segmentation of scientific disciplines and professions in a serious constraint in technological and social changes. It can be overcome when members of research teams coming from different disciplines are made jointly responsible, together with employees in enterprises, for the evaluation and utilization of results. The separation of schools from the world of work offers a similar problem. The integration of maritime education into the shipping change program has now been achieved by involving the schools directly in the early phases of new shipping projects. Such investments tend to help already closed institutions and professions to maintain their privileged roles and their lack of involvement in social change. In real life change projects the distinction between basic or fundamental research and applied or action oriented research is artificial. Good applied or action oriented research must include phases of improvements in theory and method, and is in this way dependent on basic research.

Formulation of research policy and allocation of research resources cannot be based primarily on decisions in representative committees. Steering committees can play a useful role in development projects. A major force

Formulation of research policy and allocation of research resources cannot be based primarily on decisions in representative committees. Steering committees can play a useful role in development projects. A major force in science policy making can come from scientific institutions themselves when they share their research tasks with those directly affected. When they share the evaluation and dissemination of results with organizations directly involved. Such a democratization of the research and development process is particularly important when choice of new technology and choice of new organizational form is involved.

Finally a word on new technology and unemployment.

New forms of organization and introduction of new technology in the Norwegian merchant navy has reduced the standard number of crew on each ship. The total number of seamen has also been reduced without increasing the unemployment ashore. (The unemployment is still below 2%). The reason for this is that seamen have become increasingly competent to handle new forms of work in new forms or organization. Consequently they have been prepared to move to new forms of employment and in many cases create new employment for themselves and others. Another reason has been that the school system has been involved and to some extent been changing simultaneously with the changes in technology and work organization. It is my firm belief that the unemployment problems we are facing today is only a beginning of a total redefinition of the meaning of work and of employment. A total reallocation of creative human activity between different sectors of society is needed to cope both with unemployment and with other social problems which will not be solved by turning new masses of professionals into the labour market. To improve the competitiveness of the individual firm by introduction of the latest forms of technology is also a far too limited approach. What we need to do is to make a choice of technology and relevant forms of organization within a framework of policy based on participation more than on competition. This applies to the level of companies and local communities as well as the society at large.

Mr. **LUNDINE**. Thank you. I would like to start out where you finished.

Your observation, then, is that involving the workers in a choice and design of technology is one of the most important lessons you have gotten out of this 20-year experience of yours in Norway?

Mr. **THORSRUD**. I would say definitely yes. Let me give you another example.

We have a factory making and exporting bicycles. They came to us about 10 years ago. After short consultation, they set up a traditional assembly line and ran into all the usual problems—poor quality, a lot of rejects, any stoppages, et cetera.

Then they took a lesson from this and took a very different approach to technological change. They really involved the workers. It was only by being presented with the whole problem of producing a bicycle with the use of new methods and technologies that the workers could make their contributions to a good production system, an efficient one and one where they liked to work.

It was also through this involvement of the workers that the union, which is very strong in this company, could bring reality into having some control over new technology and the consequences of it. Today this company is advanced in using robots and other innovations.

I think we are losing a lot by not using the worker, directly affected, the technician and the foreman of the department affected in the adaptation and further utilization of new technology.

I think here the Japanese have a lot to teach us. They spend much more time in these preparations, while we spend our time on patching up the system when we have not done these preparations. We get the troubles afterward.

Mr. **LUNDINE**. The issue of job security is one that you raised, and I think it is terribly important. Through several points in your explanation, you talk about cultural boundaries. Once in a while I think you can learn more about yourselves by asking an outsider to take a look at you.

In that spirit, I wonder if you have any observations about the U.S. culture, which seems to allow for very little job security, and what you would evaluate to be the impact of our penchant for layoff and then rehiring, and laying off and then rehiring on this whole socio-technical design that you are explaining and advocating?

Mr. **THORSRUD**. It is a difficult question, Congressman Lundine. Speaking from our experience in Norway and developments back in the sixties they would not have happened if they had not taken off on the basis of high level of job security and a good social security system.

I do think you have a problem here. Your system is not such that workers which are in a weak position when new technology is introduced feel sure that there is a safety net that they can fall back on. This is particularly the case where the whole economical situation becomes increasingly gloomy.

On the other hand, I don't think that the solution to this lies only in improving the social security. It is a fact, I think, that the challenge, the need for change, the understanding that change has to take place, is as important. But, then, I think you also have to give something else than unemployment compensation. Let me take an example.

The Scottish shipbuilders came to Norway in the sixties at a time when they were in real problems. Many of the Norwegian managers and union leaders who met them simply were shaking their heads and saying that there is no way you can save all your shipyards. But at least you can set up work systems so that people have a chance to prepare themselves for something else. Apart from the attempts to find new products for the industry.

This is, I think, a big challenge now. I think the auto industry probably is in for much more fundamental changes than people speak about now. I don't think you can solve that problem by simply cutting cost, by efficiency drives and to give unemployment compensation to those who are laid off. But you should very quickly, I think, look at the way people are hired, trained, and treated on the assembly line so that they themselves can prepare themselves to go into a much more flexible labor market, preferably on local community level. This will also enable you to make better cars.

Mr. LUNDINE. In other words, to take Norwegian shipping as an example, a worker who had the variety of experiences you have outlined probably would have more skills in another job, not only on the ship.

Mr. THORSRUD. Definitely. Before, an engineer would usually go back and apply for a job as a caretaker because he knew something about heating and repairs. Today he has very wide skills. He can apply for industrial and other jobs in the total labor market. The interesting thing just now is that some of the navigators too start to extend their technical knowledge and thereby improving their value in the labor market. Quite a few seamen go ashore and start small businesses.

This is better I think, than to assume that the more professionally specialized we are, the more useful we are in a changing labor situation. We need specialists as well as multiskilled people, particularly to solve employment problems on local level.

What we see now is that the most privileged of us keep our jobs in that privileged sector and make it increasingly difficult for others to enter the area at all. We see this in the public as well as the private sector.

Mr. LUNDINE. You even believe that is true of researchers.

Mr. THORSRUD. Definitely.

Mr. LUNDINE. On the subject of research, do you have any observations whether we are pursuing the best kind of research in this area, and when I say "we," I obviously am most interested in the United States, but I suspect that that might cut across some cultural boundaries, or at least national boundaries.

Would we get better results by taking a different emphasis in terms of our social science research?

Mr. THORSRUD. There is a trap here, I think, Congressman Lundine. For instance, in the social sciences, William F. White chaired the recent Congress on Sociology and claimed that it is dangerous to restrict the budgets for social sciences. Most sociologists assumed that they should go on doing the same type of social research as before. I don't think that this was what professor White had in mind. He has proved that by his own research. I am afraid we must admit that the restricted finance to social sciences is very much something that the social sciences must thank themselves for.

Part of that was explained, by Michael Maccoby. There is a historical point. We have crossed, the point now where we have to prove we can calculate almost as well as they do in the physical and natural sciences. A tendency to produce super scientific results, copying the models and methods of other sciences has produced a lot of meaningless social research. Concrete collaboration with other sciences, each bringing their contributions to solve complex problems is today the challenge and the new opportunity of this social sciences. Here I think the social sciences in the United States, which had much to contribute to other countries like Norway, has something to learn from Europe.

I would think that there also are some things government can do to stimulate good research through its own financing and its relations to the research foundations. One thing one should not do is to insist that all the money should be allocated to well-defined projects, for very specific objectives to be reached. What we are doing there is to put research money into projects where most aspects are so well understood that you almost need to have the answers in advance. The less research money there is the more we see of this. Instead, I think you should really insist on more untied money. But on what criteria can you budget your research with more untied money?

The first necessary step is to create problem-oriented, together with, or parallel to, discipline-oriented research. This does not mean to increase applied research at the expense of basic research. It means to link basic to problem-oriented research. In the social sciences particularly, the distinction between basic, applied and problem-oriented research is artificial.

Problem-oriented research tends to draw together people who are willing and able to approach an important problem irrespective what scientific discipline they come from. Environmental pollution problems, new technology and unemployment are good examples of this.

Problem-oriented research is also an important way of improving the way social science is taught. Today each discipline is a world of its own. At least, at the late stage of university education, any science, any discipline should be combined with other disciplines, preferably in the form of project work outside the university.

Interestingly enough, in Norway, it is the natural sciences who are most interested in such projects, not the social sciences. For some years now we have experimented with open, inter-disciplinary projects of 4–5 months duration. Concrete problems are tackled. For example, what problems are involved when River X is polluted? What do you do about it? From a physical, chemical, institutional point of view? Students go into open problems like that and approach them with different methods. The project method is of course not new, but used very little, partly because it requires researchers to open up their own kingdoms, and also companies and public services to open theirs.

Mr. LUNDINE. I would like to ask two additional questions, and they are related to each other so I will ask them together.

On page 2 of your testimony, you indicate that it was natural for business, government, and unions in Norway to coalesce and to enter into a quality of working life alliance.

We seem to be having trouble developing the government-business-labor cooperation here in America. I wonder what your observations about our country are in that regard.

Second, your government thought that it was a good use of public money to invest in your sort of research. Our own investments in that kind of thing have been sporadic and very small by comparison even to your own countries.

How do you think that we could get the United States Government to take a similar outlook to what the Norwegians did?

Mr. THORSRUD. First of all, as I indicated before, I think you should be careful to take over any concept from abroad, whether it is quality control circles or industrial democracy or anything else.

However, being confronted with an important national problem, like productivity and the competitive situation you have with Japan, you can mobilize collaborative programs. Or similarly the increasing youth unemployment. But, for instance, with the concept of productivity, maybe you have to redefine it before you can mobilize joint efforts. The time is right for getting together in looking at it from both labor and management point of view and to redefine productivity as well as employment. Out of that may come joint research and action programs.

When you set up a program, I think it is a good idea, as it was done in Norway, to engage researchers in helping to define the problem area. Then you need to look around and find one or more centers which are willing to commit themselves to projects that step by step are enlarged to programs of 3 to 5 years duration. In Norway in 1963 the unions and management organizations together financed a project for the first year. Joint financing is a good test of the commitment of the parties involved. Then, labor-government may come in. I think there is an important role for government and for an independent research partner. In fact, in Norway we could not have gone on if we didn't have some sort of a neutral research center and government support.

Start small, and then after you have had certain experience and developed mutual trust between those involved you can plan each step jointly and evaluate jointly after each step.

Mr. LUNDINE. Maybe that is the biggest problem. In the United States, we don't like to do anything small.

Mr. THORSRUD. I think it is a problem. However, you have quite a few examples now in the United States which started in small scale. And there are many in Europe, Australia, and even in developing countries like India.

You still have one advantage in the nature of your management, which is now becoming quite open to this sort of thinking. They have shown capability before to be fairly quick in taking new responsibilities. Also some of your union leaders have played an important role lately in this field.

Mr. **Brown**. Professor, we in the Congress have had considerable interest now, for several years, in this problem of innovation and productivity, which is the basis for these hearings.

And one of the factors consistently mentioned is one that you have addressed: The type of relationship between labor and management in this country, most generally described as adversarial.

I notice in your own work at the Work Research Institute and the industrial democracy project that you have a cooperative relationship in developing policy and plans and carrying out programs involving labor, management, and research community.

I am very much interested in how we can stimulate greater interest in that model in this country, not necessarily copying yours, as you indicated. You have had some experience at UCLA recently, and probably are familiar with the Institute of Industrial Relations there, which is more or less typical of such institutes in other universities.

It does involve some cooperation between labor, management, and the academic community, if I recall correctly. Is that correct?

I wonder if you see any possibility that we might be able to establish some sort of a National Institute of Industrial Relations which could serve as a central focal point for a network of industrial relations institutions around the country which might have as one of its charges the ways of both demonstrating and promoting a greater emphasis on cooperation between labor, management, and the research community in this important area of the work environment?

We would, in that sense, create something like your Work Research Institute in Norway, building on some of the things we already have. This may be utterly unrealistic, but I thought I would mention it and ask you to comment.

Mr. **Thorsrud**. I would be skeptical about one national institute. There are so many Americas, even in the United States. I think it would be better to have another way of achieving the same aim.

It may be better to have some sort of program committee on the national level, on the Federal level, where there is a tripartite general interest in this area. And then to involve many institutes, many centers inside and outside the academic community, and on the boundary of it. Then you should perhaps allocate special budgets for collaboration between these centers conducting different projects and programs.

You have a point, Mr. Brown. It has to be signaled from top political level, that there is some two- or three-partite arrangement desirable and later there is a need for top-level support without authorized directives.

Institutions who are not willing to work with both labor and management, can hardly participate in programs of this nature.

You cannot demand them always to have a joint labor-management support or collaboration, because it doesn't exist in many cases. But you can demand that they don't exclude any party or group which are affected by the projects to have a say in them if they so desire.

I would perhaps add also that one should not try to force good university institutes to become bad applied institutes just to get a hold of money. It is much better that they remain good on theory and method and some types of teaching, and then to have them collaborated with fairly independent, program-oriented centers at the boundary of the university. This independent boundary position is the one we have in our institute. We are financed partly by Government money, partly by project and program money.

These boundary centers represent something in the middle between the pure, discipline-oriented institutes on the one hand and, on the other, the totally applied oriented units attached to a hospital, a corporation or a union.

These independent units at the boundary are more able and willing to accept the challenges and constraints that you face under tripartite arrangements.

Mr. **Brown**. Our next witness is going to report on some of the studies done by our General Accounting Office on this subject. He makes the point that we have no central focus in the Federal Government for efforts of this sort; that our Labor Department, which nominally should have the responsibility, is not organized or programed to do that; and that we even have a National Productivity Council established by law, which is ignored and is carrying out no function. It may even be abolished in this administration.

The question is whether the importance of mobilizing or stimulating improved national economic productivity is such as to justify a stronger Federal role centered in the Labor Department or in some other appropriate organization. Apparently we just have not given this very high priority in this country.

Are you familiar with efforts in the Federal Government to stimulate this kind of activity?

Mr. **Thorsrud**. Well, I think that you have something which could be promising. That is the allocation of money to small firms and cooperative enterprises. The money is, I understand, distributed widely over a broad spectrum of different types of enterprizes all over the country. That is one form of stimulation of the kind of activity you may need, particularly for the benefit of local communities.

I would be careful with any type of singular sort of monolithic institution to direct the activities. But you need leadership and resources on local as well as central level.

The leading forces here should come more from the periphery than from the center. But when the periphery has shown some progress, then I think political leadership should be able to support it but not to dominate it. We need a new kind of leadership which can understand and do this. One has to listen to the ground today to find out what to do and how to do it. That does not mean we can do without leadership at the center.

Mr. **Brown**. Let me ask you about another matter that you discussed in your paper. You mentioned on page 5 of your statement that your country passed a new law on work environment in 1977 which provided for a greater degree of worker participation in matters such as the health and safety in the workplace. One of the most unpopular programs the Federal Government operates in this country is the OSHA program which places the responsibility for health and safety in a Federal bureaucracy.

Is there any way that you perceive that we could reduce Federal expenditures and Federal bureaucracy in the OSHA organization, Occupational Safety and Health Administration, by delegating this specifically to some acceptable form of worker-management organization in the workplace?

In other words, and this is in accordance with the philosophy of this administration, is there a way to decentralize programs and get the Federal Government less involved, instead of more involved?

Could we point to the success of your program in Norway and say we could reduce the Federal budget by doing this?

Mr. THORSRUD. Well, I think we have a model that could be used exactly as you indicate. Allocate money to a program administered on the local level, basically at the level of the company under joint union and management control. We are, in fact, doing that in Norway, and Canada seems to be taking the same trend. Then, if you do that, I don't think you can at the same time take away important restrictions regarding safety. I think you are doing just now, making it easier to make money short term but at the same time increasing the risk for severe accidents to happen. One can't do that and at the same time be serious about the decentralized approach.

Health and safety in industry is only one aspect of this important problem. In other countries we are not at all happy with seeing some of the latest news from the States in lifting certain restrictions. You may reduce some of your problems and put them into other countries, like chemicals and things you can't sell or get rid of here. That sort of policy will not give any confidence in a decentralized approach. But still, locally administered health and safety programs has a good prospect. Over time they are more effective and cheaper.

Mr. LUNDINE. I would like to call on counsel for the minority. Questions from the other side.

Mr. RHEEM. Mr. Rheem. Thank you, Mr. Chairman.

You brought up in your testimony, and it also came out in the questions, the need to develop new measurements for productivity. I wonder if you could elaborate on that?

Does developing new measurements of productivity involve redefining productivity? And, as a related question, what incentives will there be for American managers, who, we know over recent years have become highly analytical, and also have become very short term in orientation, to embody these new measurements?

Mr. THORSRUD. I am glad this was raised so that I can be more concrete. Interestingly enough, out of projects for example, in the ships, the seamen themselves came up with interesting new measures of productivity. In one of the experiments the company didn't at all concentrate on saving money. But then the crew set up their own system of local cost control. They would like to have comparative data from other ships on very important cost factors, like times of waiting in the harbor, cost of keeping reserve parts in stock, et cetera.

Two hours in harbor may in some cases pay for two or three seamen for a whole year. This illustrates the whole situation. I think we have been spoiled by a sort of numerical disease in the budgeting and cost control. We measure with great care what is easy to measure, but very often we let the big things go by. For instance, the cost of increased scrap or the cost of not using people's creative ability in the department to improve its overall efficiency. To measure productivity on departmental level is a big step away from the too simple measure of man-hour output.

If you start working with these new measures, you will find, I think, in most cases, that you have to have special measures for each individual firm. Let's say in the paper and pulp plant, the time it takes to shift from one product to another is indeed a crucial factor. In another plant, it is the correction of parts below standard. These are well known examples. Let us just mention one more, the saving of energy. This may in many cases be a most important measure, and it is one in which it is easy to see how important it is to involve people on all levels.

Regarding productivity you certainly will have to include the unemployment factor and other basic aspects.

As my colleague, Professor Maccoby, indicated, you have to take a look at the basic values. It sounds very philosophical, but it can be made very concrete if you start defining them on departmental and company level, and on the level of the local community. For instance, the value of safe employment. Here I think the Japanese have a great gain over us when they have developed as a criteria of a good company its ability to keep people employed over time.

Mr. LUNDINE. Thank you very much for joining us this morning. We appreciate your testimony, and it has been, to me at least, very enlightening. Thank you very much.

Mr. LUNDINE. Now I would like to call on Brian Usilaner, associate director of the National Productivity Group with the General Accounting Office.

STATEMENT OF BRIAN USILANER, ASSOCIATE DIRECTOR OF THE NATIONAL PRODUCTIVITY GROUP, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY ED FRITZ, GROUP DIRECTOR FOR PRIVATE SECTOR PRODUCTIVITY

Mr. USILANER. Thank you, Mr. Chairman.

I have with me, Mr. Ed Fritz, who is group director for Private Sector Productivity within the General Accounting Office.

With your permission, I would like to submit my entire testimony for the record and concentrate this morning on its highlights.

I am pleased to be here today to discuss the human factor in productivity. The General Accounting Office has been examining various aspects of the productivity problem for about a decade. With productivity growth virtually stagnant during the last few years, we have watched as productivity developed from a somewhat esoteric area of study to a topic of national concern.

The productivity slowdown has been caused by many factors, including capital investment, technology, innovation, work methods and, of course, the productive quality of the work force. While much is now being done to encourage productivity improvement, most activities are directed toward stimulating capital investment, and introducing new technology, and innovation. An example is the new tax package recently signed by President Reagan.

The investment of capital and the introduction of new technology each play a part in boosting productivity, but the human resources of the organization are clearly at the heart of any productivity improvement program. Discussions about our efforts to improve productivity, however, often downplay the human factor.

One reason for this is management finds it easier to place the blame for productivity problems not on itself but on government regulations, tax policy, higher energy and material costs, or unjustified wages increases.

Another reason is that the human factor is more difficult to quantify.

It is difficult for an objective observer to understand why the management of human resources is not more prominently featured in efforts by firms to improve productivity. It may be that the role of labor in productivity growth is so fundamental, so obvious, that managers stare right past it. According to the president of the Work in America Institute, the human factor contributes between 10 and 25 percent to productivity growth. People account for 50 percent or more of controllable costs, and in labor intensive service operations, they may account for 70 to 80 percent of all costs.

Today I will address some of the reasons why human resource productivity has not been emphasized in efforts to improve productivity, and the role the human factor can play. I will also share with the subcommittee some related findings from our work at GAO, and will also address the current shortcomings in Federal efforts to encourage improvements in human resource productivity.

There is now a growing consensus, both at home and abroad, that the performance of American management of late has been sorely lacking; that to some extent, management techniques developed by Americans are being ignored here. Further, American corporate leaders have been slow to adapt to the rapidly and profoundly changing work force.

No one seriously blames management entirely. But according to a recent Wall Street Journal report, 80 percent of the top managers at 221 companies cited poor management as a major reason for lackluster productivity. A major reason why some of the successful management practices are not being extensively used by American management is that they, for the most part, involve employee participation in management and decisionmaking. Such participation serves to make employees equal partners in the operations of the firm. This is unacceptable to many managers. Yet, this resistance to participative management is in large part the problem.

Trust is lacking in much of American management and this lack of trust has been formalized in the management of human resources. The experiences of many innovative U.S. companies have shown that by demonstrating trust based on mutual respect and commitment in their management style, productivity can be significantly improved. Management style is critical to improving human resource productivity since it creates the environment which allows productivity to flourish.

The many firms stubbornly clinging to old management styles that view workers as mere tools in the production process are not able to realize the many benefits that effective incentive systems and improved labor management cooperation can bring. This has been brought out to us many times in several roundtable discussions we have hosted over the past few years.

Historically, management and workers have had different goals: Managers strive for productivity improvement; that is, raised output with reduced labor input; workers mainly seek increased pay and improved job security. Though workers and unions are aware that increased productivity in the long run also benefits workers as reduced costs insure new orders, jobs and the company's ability to pay increased wages and benefits, they are more concerned with what affects them directly and are generally indifferent or at times hostile to management's unilateral attempts to increase productivity.

But these different goals can be reconciled when workers are given the opportunity to share in the increased productivity they create. In our study entitled, "Productivity Sharing Programs: Can They Contritute to Productivity Improvement?", we documented some of the benefits that can result from a productivity bonus program. In these programs, firms agree to share productivity savings with the work force. To date, we have distributed over 9,000 copies of this report; almost entirely at the request of private firms.

We found that many firms with productivity sharing programs realized significant savings in work force costs as well as such nonmonetary benefits as reduced turnover and absenteeism, and fewer grievances. Annual work force savings at 24 firms we visited averaged about 17 percent.

A particular example that you are familiar with, Mr. Chairman, of productivity sharing programs was a company of about 600 employees that had a history of poor union-management relations with a lot of grievances and a constant threat of strikes. A labor-management committee was formed at the suggestion of a community labor-management coordinator. One of the recommendations they made was to come up with a productivity sharing program. We visited this company, and over the last 2 years they have improved productivity 17 percent annually. They attribute a lot of the improvement to the productivity sharing program.

It is very significant that the key obstacle we identified to the effective implementation of these programs was management resistance to the basic concept of sharing decisionmaking and productivity gains—another indication of the lack of trust.

Implicit in any incentive programs is the understanding that no employees will be laid off or fired as a result of productivity improvement. What I am talking about here is a fundamental part of improving labor-management relations.

One effective approach to building needed labor-management cooperation is the use of labor-management committees. These committees, which can exist within a firm, an industry or a community, are effective because they enable employees to feel more involved in the firm and more in control of their own work; draw on the job knowledges workers; and allow labor and management to solve many problems in a nonadversary environment. Examples of successful labor-management committees in firms abound at all three levels. Many of which, Mr. Chairman, you are well aware of.

The Federal role in labor-management cooperation is understandably limited. The Government, however, can and has been instrumental in the development of some labor-management committees through the provision of seed money, information, and technical assistance. We have supported the Federal Mediation and Conciliation Service's grant program for labor-management committees and we are hopeful it will be funded in fiscal year 1982.

In my opinion, the main reason that labor-management committees have not been more widely used is that the arrangement generally becomes acceptable to labor and management only as a last resort. If such committees could be formed under favorable conditions, they would help diffuse many issues before they become serious problems.

Another area where management style affects human resource productivity is in the application of automation and technology. It is critically important that management considers the needs of blue and white collar workers affected by the introduction of new technologies as emphasized by our last two speakers. If employees are considered merely another element of the production process, rather than a resource with a stake in the company, the best equipment and technology will not produce as intended.

The impact of technology and automation on the work force raises many serious questions. For example, how many jobs will be lost and by the same token, how many will be created by the new technology? And how will management deal with labor's fears of displacement to insure acceptance of the machines?

A need for new skills will accompany any new jobs created by automation. Other skills will become obsolete. Who is defining what kind of skills will be needed and who will be responsible for assuring that the required shift occurs with a minimum of social cost? How will automation change the environment of the work force?

We at GAO are now studying who in Government is addressing these questions. So far, we have found that little is known about how rapid or severe job displacement due to automated technology will be. The Department of Labor generally assumes that the future trend will be similar to the pattern of automation in the sixties when there was an abundance of new jobs caused by economic growth and little resistance to change. However, as the Joint Economic Committee's 1981 review of productivity noted, a stagnant economy such as we have now causes resistance to new technology and a much stronger incentive to preserve existing jobs.

We have also found that the Government places little emphasis on retraining in its employment programs. For example, CETA focuses primarily on the structurally unemployed. Only a small percentage of available funding is allowed by law to be used for retraining workers threatened with layoffs.

In addition, it appears that no one is taking available information on the types of skills both created and rendered obsolete and translating it into a definition of educational needs. As an example, CETA programs are training too many people for the very skills that robots are able to perform. These points and others will be pursued in our current study of the Federal role in automation and robotics.

We have also looked at the productivity improving potential of office automation for the clerical and professional worker. While the potential of office automation is great, there are many obstacles to its effective implementation. Chief among these is the worker's resistance to the technology. Unless this obstacle is overcome, the resources spent to procure this technology may be wasted, as well as the productivity improving potential.

As we have shown in this discussion, the main impetus for improving the human factor in productivity will come from the private sector, with minimal Government involvement. It must be recognized, however, that the Federal Government already plays a significant role that has a pervasive effect on the Nation's productivity, both directly through ongoing programs administered by individual agencies, and indirectly through taxes, subsidies, regulations, fiscal policies, et cetera.

Of particular concern to us at GAO is the lack of focus at the Federal level regarding productivity improvement. We are not calling for increased intervention in the economy, but we do believe the Government should better plan and focus its own efforts to encourage private sector productivity growth, as Congressman Brown brought out before.

According to the Office of Management and Budget, Federal agencies spent about $36 million in fiscal 1980 on human resource productivity programs related to protection and improvement of the quality of working life, the utilization of employee skills, and improving labor-management relations. The Department of Labor was given specific leadership authority in this area.

Our 1980 report on Labor's productivity activities showed that the Department of Labor had not assessed private sector needs to determine what Federal actions should be taken to improve productivity; not developed a Department-wide productivity plan; not designated a departmental focal point to promote and coordinate activities with other agencies; and not evaluated its ongoing productivity projects in terms of their impact on productivity.

Having neither leadership nor an overall plan to guide Federal assistance, agencies cannot determine needed projects, the proper level of support, the existence of overlap or duplication, or obtain guidance and information.

We also found that since the Department had no specific legislative requirement for work in this area, human resource productivity has received a low priority. We recommended to the Department of Labor that they develop specific program goals and objectives for improving human resource productivity, coordinate and monitor the Department's programs in this area, and coordinate human resource programs in other agencies. We also recommended that the Congress enact legislation making the Labor Department accountable to the Congress for the results of its human resource productivity efforts. To date, no action has been taken on either recommendation.

On a broader level, we found the National Productivity Council to be ineffective and largely ignored the functions assigned to it. This lack of action is difficult to understand since OMB identified over $2 billion spent in fiscal 1980 on programs directly related to private sector productivity improvement. Although the Executive order which established the Council is still on the books, the Council is inactive and the order is likely to be rescinded.

We believe a need remains for an effort to coordinate and guide existing Federal productivity programs and provide a productivity perspective in economic and budgetary decisionmaking.

Such an effort should be established by law, have clear and realistic functions, and be devoted to developing and monitoring a productivity plan and coordinating the national productivity effort at the Federal level.

In closing, I would like to commend the chairman and the members of the subcommittee for holding these hearings. The subject matter is of great importance to our economy and competitiveness and yet is often overlooked. I believe that the Congress can help by publicizing the importance of productivity and demonstrating during these hearings that the ability to improve productivity exists and great potential is waiting to be tapped.

The committee may consider holding regional hearings on this subject or encourage other committees to hold hearings on other aspects of human resource productivity, such as training and automotion. We, of course, would be pleased to assist the committee in any way we can.

In summary, actions to improve human resource productivity must include three basic elements: the development of a nonadversary relationship between management and labor; the sharing of the benefits of productivity improvement; and a thorough change in management style, based on trust.

To put it bluntly, capital and technology by themselves produce nothing. A machine, a process, or a system may be ever so brilliantly contrived, but it is no more effective than the people operating and managing it want it to be, or know how to make it.

American managers must stop blaming declining productivity on Government and economic conditions. They must look at their management styles and then work with their employees to jointly improve productivity. Neither management nor labor nor Government can solve the productivity problem alone. Only through a combined effort, based on common interest and mutual trust, will the obstacles to productivity improvement be overcome.

Thank you.

[The prepared statement of Mr. Usilaner follows:]

STATEMENT OF BRIAN L. USILANER, ASSOCIATE DIRECTOR, NATIONAL PRODUCTIVITY GROUP, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION

Mr. Chairman and members of the subcommittee, I am pleased to be here today to discuss the human factor in productivity. The General Accounting Office has been examining various aspects of the productivity problem for about a decade. With productivity growth virtually stagnant during the last three years, we have watched as productivity developed from a somewhat esoteric area of study to a topic of national concern.

The reasons for this concern are easy to understand. First, the problem of inflation remains an acute one, and the slowdown in productivity growth is an important contributor to the problem. Second, there is now a greater understanding that productivity growth has been a major factor in advancing the well being of the American people.

The productivity slowdown has been caused by many factors including capital investment, technology, innovation, work methods, and, of course, the productive quality of the work force. While much is now being done to encourage productivity improvement, most activities are directed toward stimulating capital investment, and introducing new technology, and innovation. An example is the new tax package recently signed by President Reagan. One objective of this change in tax policy is to stimulate productivity growth through incentives for saving and for investment in new plants and equipment. The investment of capital and the introduction of new technology each play a part in boosting productivity, but the human resources of the organization are clearly at the heart of any productivity improvement program. Discussions about or efforts to improve productivity, however, often downplay the human factor.

One reason for this is management finds it easier to place the blame for productivity problems not on itself but on Government regulations, tax policy, higher energy and material costs, or unjustified wage increases. Another reason is that the human factor is more difficult to quantify.

However, even with the difficulties in quantifying the human factor, evidence clearly indicates that efforts to improve productivity by emphasizing the human factor can bring significant results.

It is difficult for an objective observer to understand why the management of human resources is not more prominently featured in efforts by firms to improve productivity. It may be that the role of labor in productivity growth is so fundamental, so obvious, that managers stare right past it. According to the president of the Work in America Institute, the human factor contributes between 10 and 25 percent to productivity growth. People account for 50 percent or more of controllable costs, and in labor-intensive service operations they may account for 70 to 80 percent of all costs.

Today I will address some of the reasons why human resource productivity has not been emphasized in efforts to improve productivity, and the role the human factor can play. I will also share with the subcommittee some related findings from our work at GAO, and will also address the current shortcomings in Federal efforts to encourage improvements in human resource productivity.

There is now a growing consensus, both at home and abroad, that the performance of American management of late has been sorely lacking; that to some extent, management techniques developed by Americans are being ignored here. Further, American corporate leaders have been slow to adapt to the rapidly and profoundly changing work force. No one seriously blames management entirely. But according to a recent Wall Street Journal report, 80 percent of the top managers at 221 companies cited "poor management" as a major reason for lackluster productivity. This view seems to be supported by Japanese management. For example, the president of Honda has reportedly expressed little concern about the greatly increased capital investment now being made by American automakers. He believes that the key to productivity improvement is management.

The importance of management was also brought out in a recent report prepared for the Department of Transportation that concluded that it is management, and not technology, that allows the Japanese to produce automobiles in many fewer hours than U.S. manufacturers.

It is not as if American management is unable to be innovative, especially in the human resource field. Peter Drucker has observed that "Europe and Japan now have the managerial edge in many of the areas which we used to consider American strengths, if not American monopolies." He has also noted that many of the effective management practices being used overseas, such as quality control circles, were American in origin.

A major reason why some of these management practices are not being extensively used by American management is that they involve employee participation in management and decisionmaking. Such participation serves to make employees equal partners in the operations of a firm. This is unacceptable to many managers. Yet, this resistance to participative management is in large part the problem.

Trust is lacking in much of American management and this lack of trust has been formalized in the management of human resources. The experiences of many innovative U.S. companies have shown that by demonstrating trust based on mutual respect and commitment in their management style, productivity can be significantly improved. Management style is critical to improving human resource productivity since it creates the environment which allows productivity to flourish.

The many firms stubbornly clinging to old management styles that view workers as mere tools in the production process are not able to realize the many benefits that effective incentive systems and improved labor management cooperation can bring. This point was brought out in a roundtable session we hosted last year. A distinguished group of representatives from business, labor, and academia concluded that quality and productivity problems in American industry were largely management problems; management often did not provide the proper incentives or environment for quality and productivity. They also stressed that decisions should be pushed to the lowest levels possible to develop more employee involvement and responsibility. Of course this would also mean that management must share information with workers, divide with them the gains resulting from increased participation, and work harder to ensure job security.

Historically, management and workers have had different goals: Managers strive for productivity improvement, i.e., raised output with reduced labor input; workers mainly seek increased pay and improved job security. Though workers and unions are aware that increased productivity in the long run also benefits workers as reduced costs insure new orders, jobs, and the company's ability to pay increased wages and benefits, they are more concerned with what affects them directly and are generally indifferent or at times hostile to management's unilateral attempts to increase productivity.

In our study entitled "Productivity Sharing Programs: Can They Contribute to Productivity Improvement?," we documented some of the benefits that can result from a productivity bonus program that includes all employees. In these programs, firms agree to share productivity savings with the work force. To date, we have distributed over 9,000 copies of this report; almost entirely at the request of private firms.

We found that many firms with productivity sharing programs realized significant savings in workforce costs as well as such nonmonetary benefits as reduced turnover and absenteeism, and fewer grievances. Annual workforce savings at 24 firms we visited averaged about 17 percent. To cite some specific examples:

A manufacturing firm with approximately 2,000 of its 2,300 domestic employees covered by a sharing plan saved an average of 24 percent of participating work force cost in the last 5 years with its plan. Annual savings ranged from 20 to 35 percent. A company official stated that savings resulted from implemented employee suggestions and from the increased productivity of employees who were "working smarter and harder."

At another manufacturing company, 215 of the 225 employees were covered by productivity sharing. Average savings over the latest 5-year period was 14 percent of work forces cost and ranged from 11 to 18 percent. Improved employee performance and less resistance to labor-saving approaches were described as important facts influencing savings.

A company of about 600 employees had a history of poor union-management relations. With a number of unresolved grievances and a major strike threatening, the company turned to the formation of a labor-management committee at the urging of a community labor-managment coordinator. It was agreed that one way to turn around the company's low productivity rate and poor labor-management relations would be to implement a productivity sharing program. Such a program was established in 1978 and during the last two years, labor-management relations have improved dramatically and productivity has improved 17 percent annually.

It is very significant that the key obstacle we identified to the effective implementation of these programs was management resistance to the basic concept of sharing decision-making and productivity gains—another indication of the lack of trust.

Implicit in any incentive programs is the understanding that no employees will be laid off or fired as a result of productivity improvement. Firings and layoffs are management statements that employees are not expected to have the same goals as management; that labor is simply another tool in the production process and not a partner with management in that process. Not surprisingly, this approach often results in labor's disinterest in the firm's profitability. What I am talking about here, or course, is a fundamental part of improving labor-managment relations.

The traditional adversary relationship between labor and management is a great hindrance to productivity improvement. Both labor and management lose in the adversary process. Labor and management must realize they are both part of the same organization, and their livelihoods are dependent on the success or failure of the organization. One effective approach to building needed labor-management cooperation is the use of labor-management committees. These committees—which can exist within a firm, an industry, or a community—are effective because they: Enable employees to feel more involved in the firm and more in control of their own work; draw on the on-the-job knowledge of workers; and allow labor and management to solve many problems in a nonadversary environment.

Examples of successful labor-management committees in firms abound. One of more frequently cited success stories is General Motor's Tarrytown, New York assembly plant where a quality of work life program broke down many traditional barriers between labor and management with impressive results. While measurement of the results is difficult, absenteeism dropped from about 7 percent before the program to between 2 and 3 percent after. Registered grievances dropped to 32 after the program from a high of about 2,000 for a similar period prior to the quality of work life program. Once the poorest in quality performance, the plant is now among the top GM plants.

Labor-management cooperation can also significantly influence productivity when it goes beyond the firm level. In 1979 we visited area-wide labor-management committees in Jamestown and Buffalo, New York, Clinton County, Pennsylvania, and Cumberland, Maryland. These committees work to improve the labor relations climate and economic health of their communities by supporting plant level committees, helping to end long-term strikes, working to attract industry, and examining economic development problems. They have all experienced considerable success.

For example, in Buffalo, labor and management leaders established a committee in 1976 after five years of serious job losses and a leading record in working time lost due to strikes. The committee played a major role in reversing Buffalo's economic decline. From 1976 to 1979, total employment increased 10 percent; adding almost 50,000 jobs. Working time lost due to strikes fell steadily.

Industry cooperation at the local or national level can address important issues that are beyond the scope of any single firm. We are currently examining the effectiveness of Federal efforts to improve productivity in two industries—railroads and construction. These efforts include the promotion of labor-management cooperation. The Federal Railroad Administration (FRA), for example, has established labor-management projects at several rail terminals. These projects require several railroads and unions to cooperate. Steering committees, composed of representatives from labor, management, and FRA, implement experiments to address particular problems that impede productivity. The results are evaluated and, if successful, may be adopted by the railroads.

The construction coordinating committees, established by the Department of Labor in five cities, bring together labor, management, and officials from Federal, State and local Governments. The primary purpose of these committees is to reduce seasonality—that is, level out the construction year peaks and valleys so that employment and equipment utilization can be stabilized. In addition, the committees discuss Government regulations and other issues that may be impeding productivity growth.

The Federal role in labor-management cooperation is understandably limited. The Government, however, can and has been instrumental in the development of some labor-management committees through the provision of seed money, information, and technical assistance. We have supported the Federal Mediation and Conciliation Service's grant program for labor-management committees and were pleased to learn that fiscal 1982 funding was authorized for this modest but effective program.

In my opinion, the main reason that labor-management committees have not been more widely used is the arrangement generally becomes acceptable labor and management only as a last resort. If such committees could be formed under favorable conditions, they would help diffuse many issues before they become serious problems.

Another area where management style affects human resource productivity is in the application of automation and technology. It is critically important that management considers the needs of blue and white collar workers affected by the introduction of new technologies. If employees are considered merely another element of the production process, rather than a resource with a stake in the company, the best equipment and technology will not produce as intended.

Labor generally has not resisted automation and robotics when they have relieved workers from hazardous, dangerous, or monotonous jobs. But as more sophisticated robots are developed and widely adopted, greater numbers of workers may be displaced. This raises a number of questions. How many jobs will be lost and, by the same token, how many will be created by the new technology? And how will management deal with labor's fears of displacement to ensure acceptance of the machines?

A need for new skills will accompany any new jobs created by automation. Other skills will become obsolete. Who is defining what kind of skills will be needed and who will be responsible for assuring that the required shift occurs with a minimum of social cost?

We at GAO are now studying who in Government is addressing these questions. So far we have found that little is known about how rapid or severe job displacement due to automated technology will be. The Department of Labor generally assumes that the future trend will be similar to the pattern of automation in the 1960's when there was an abundance of new jobs caused by economic growth and little resistance to change. However, as the Joint Economic Committee's 1981 midyear review of productivity noted, a stagnant economy such as we have now causes resistance to new technology and a much stronger incentive to preserve existing jobs.

We have also found that the Government places little emphasis on retraining in its employment programs. For example, CETA focuses primarily on the structurally unemployed. Only a small percentage of available funding is allowed by law to be used for retraining workers threatened with layoffs. In addition, it appears that no one is taking available information on the types of skills both created and rendered obsolete and translating it into a definition of educational needs. These points and others will be pursued in our current study of the Federal role in automation and robotics.

We have also looked at the productivity improving potential of office automation for the clerical and professional worker. While the potential of office automation is great, there are many obstacles to its effective implementation. Chief among these obstacles is the worker's resistance to the technology. Unless this obstacle is overcome, the resources spent to procure this technology may be wasted.

As we have shown in this discussion, the main impetus for improving the human factor in productivity will come from the private sector, with minimal Government involvement. It must be recognized, however, that the Federal Government already plays a significant role that has a pervasive effect on the Nation's productivity, both directly through ongoing programs administered by individual agencies, and indirectly through taxes, subsidies, regulations, fiscal policies, etc. Of particular concern to us at GAO is the lack of focus at the Federal level regarding productivity improvement. We are not calling for increased intervention in the economy, but we do believe the Government should better plan and focus its own efforts to encourage private sector productivity growth.

According to the Office of Management and Budget (OMB), Federal agencies spent about $36 million in fiscal 1980 on human resourse productivity programs related to protection and improvement of the quality of working life, the utilization of employee skills, and improving labor management relations. The Department of Labor was given specific leadership authority in this area.

Our 1980 report on Labor's productivity activities showed that the Department of Labor had: Not assessed private sector needs to determine what Federal actions should be taken to improve productivity; not developed a Department-wide productivity plan; not designated a Departmental focal point to promote and coordinate activities with other agencies; and not evaluated its ongoing productivity projects in terms of their impact on productivity.

Having neither leadership nor an overall plan to guide Federal assistance, agencies cannot determine needed projects, the proper level of support, the existence of overlap or duplication, or obtain guidance and information.

We also found that since the Department had no specific legislative requirement for work in this area, human resource productivity has received low priority.

We recommended to the Department of Labor that they develop specific program goals and objectives for improving human resource productivity, coordinate and monitor the Department's programs in this area, and coordinate human resource programs in other agencies. We also recommended that the Congress enact legislation making the Labor Department accountable to the Congress for the results of its human resource productivity efforts. To date, no action has been taken on either recommendation.

On a broader level, we found the National Productivity Council to be relatively inactive, and it largely ignored the functions assigned to it. This lack of action is difficult to understand since OMB identified over $2 billion spent in fiscal 1980 on programs directly related to private sector productivity improvement. Although the executive order which established the Council is still on the books, the Council is inactive and the order is likely to be rescinded.

We believe a need remains for an effort to coordinate and guide existing Federal productivity programs and provide a productivity perspective in economic and budgetary decisionmaking.

Such an effort should be established by law, have clear and realistic functions, and be devoted to developing and monitoring a productivity plan and coordinating the national productivity effort at the Federal level. Obviously, human resources management must be an integral part of any program directed at improving national productivity, as must an effort to build a cooperative atmosphere among government, business, and labor.

In closing, I would like to commend the Chairman and the members of the subcommittee for holding these hearings. The subject matter is of great importance to our economy and competitiveness and yet is often overlooked. I believe that the Congress can help by publicizing the importance of productivity and demonstrating during the hearings that the ability to improve productivity exists and great potential is waiting to be tapped. The committee may consider holding regional hearings on this subject or encourage other committees to hold hearings on other aspects of human resource productivity such as training and automation. We, of course, would be pleased to assist the Committee in any way we can.

In summary, actions to improve human resource productivity must include three basic elements: the development of a nonadversary relationship between management and labor, the sharing of the benefits of productivity improvement, and a thorough change in management style based on trust.

To put it bluntly, capital and technology by themselves produce nothing. A machine, a process, or a system may be ever so brilliantly contrived, but it is no more effective than the people operating and managing it want it to be, or know how to make it.

American managers must stop blaming declining productivity on Government and economic conditions. They must look at their management styles and then work with their employees to jointly improve productivity. Neither management nor labor nor Government can solve the productivity problem alone. Only through a combined effort, based on common interest and mutual trust, will the obstacles to productivity improvement be overcome.

Mr. LUNDINE. Thank you very much.

Fortunately, you were here and heard the testimony of the two previous witnesses. At various times both of them suggested we need a broader definition of productivity. And we need to resist the temptation to quantify precisely, or crudely, I guess you would put it. Your office is uniquely charged with the responsibility of quantifying and reporting to the Congress.

First of all, would you agree with those comments that we need to look at productivity in a broader context?

And second, do you have any ideas on how we could achieve that broader view of productivity?

Mr. USILANER. There was a National Academy of Science task force that was put together a few years ago to look at productivity measurement. Many of the comments that they received before they initiated their study was on how to change the definition of productivity to include social costs.

The conclusion that they came up with is people are reading into productivity measures more than is there. Productivity measurement simply is input related to output, or the efficient utilization of resources. People have a tendency to read into productivity many more things.

What we advocate at GAO is what we call a total peformance measurement system in which one part of that measurement pie is something called productivity. There are other types of measurements, such as quality, and effectiveness, especially in government type programs. These measures would include Social costs, as you talk about.

In answer to your question, we do not advocate tampering with productivity measurement in and of itself. The problem is more that we need other costs in relationship to productivity to better understand the total aspects of performance.

Mr. LUNDINE. Also, you heard Professor Thorsrud testify, and I really appreciate his phrase about untied research. You had the opportunity of hearing his comments that what we need is really more participation in the research process, and less narrow applications on research assignments.

From your perspective as the government's watchdog, do you think that that is possible, that we could actually achieve that kind of result, particularly in the area of social sciences?

Mr. USILANER. Yes, I think so. I think that NSF has the flexibility and the opportunity to try to build that into in a lot of their grants. This point was really brought home in the area of office automation and technology, which we are now studying. We went out to the private sector because we thought they were further ahead than the government.

In many of the success stories we found included employees, top management and researchers or consultants working together to identify the needed technology. It was a joint effort. I think that just underscores the point of researchers needing to work with the workers who are going to use the technology or results of the research.

Mr. **Lundine**. You pointed out that 80 percent of the executives recognize that poor management is responsible for lagging productivity, but as you just again reiterated, there seems to be a continuing resistance and skepticism about worker participation. How do you explain that contradiction, and is there a government role, or is there a role that the government can play in making the good news of the successes more available so as perhaps to influence managers?

Mr. **Usilaner**. The study that was done by the Wall Street Journal is extremely recent. I don't have the exact date, but it was in the last several months. Older studies that we have hold of show that managers have been blaming government, unions, increasing wages and so on. So I want to emphasize that that is a recent attitude. I have to underscore that it appears to me as a recent change in attitude on the part of management. They are finally realizing that it is the poor management, and they are not looking outside and blaming others.

I would say that this change in attitude has taken place in the last year or 18 months. I don't see it as a contradiction. I see it as a very positive movement in change of attitude, a lot of introspection to try to look within to find causes instead of blaming outsiders.

In answer to your question about the government role, we recently did a study for the House Ways and Means Committee, Subcommittee on Trade, to take a look at comparing United States and Japan product quality. We put together a round table of leading authorities in this area, and the conclusion was that it was management and not technology that was causing the Japanese advantage in productivity and quality.

We attempted to publicize the results of that. The subcommittee has held regional hearings in order to publicize that. So I think, there is a Federal role in information and awareness.

Mr. **Lundine**. I don't really have another question, but you make some excellent points, in my estimation here, that don't relate to the Science and Technology Committee. I assume that you would have no objection if I would, as I intend to do, make the Office of Management and Budget aware of your comment as to their failures, make the Department of Labor aware of what they have not achieved, that they have already been legislated to achieve, and also, dear to my heart would be to make the Appropriations Committee aware of your comments on funding the labor-management cooperation angle.

Mr. **Usilaner**. I appreciate the support that you have given to productivity efforts during your terms in Congress. We are still hammering away in trying to convince the administration of a need for a focal point.

Mr. **Lundine**. Mr. Walgren.

Mr. **Walgren**. No questions, Mr. Chairman.

I certainly appreciate your testimony.

Mr. **Usilaner**. Thank you.

Mr. **Lundine**. Mr. Brown.

Mr. **Brown**. I am concerned about how we are to generate some motivation on the part of both the administration and the private sector to move in the direction that our witnesses, including yourself, have indicated. We have a problem here which is somewhat similar to the problem that we have in trying to encourage the private sector to engage in a more effective program of long range planning. The economic imperatives and general philosophy tend to focus on the short run profitability, and not on long range planning.

The prevailing concepts of the enterprise seem to focus on the role of ownership and management in doing all of the planning and organizing, and not on involving the work force in processes of improving productivity. In other words, we have either economic or philosophical imperatives here which have inhibited the move toward more effective and longer range planning and operation.

Now, you have suggested a couple of ideas; one being, the concept of considering management and the work force as equal partners, and the other being a commitment to the sharing of productivity gains, both of which would be extremely difficult.

Mr. **Usilaner**. Yes, I agree this will be difficult.

Mr. **Brown**. I think one of the other witnesses used a term which would be a little easier to get across to management in terms of involving the workers. That was "limited partnership" instead of equal partnership. If we could define the differences, it might be a little easier to sell to our management leaders in this country.

You see no problem, I presume, with any steps that would lead to a greater participation by the work force, even if we called it limited partnership?

Mr. **Usilaner**. In fact, studies and our work have shown that when workers are asked to participate in areas outside of their boundaries, they actually resist. So obviously, there are areas such as on policy, and the overall running and direction of the company, that workers have no knowledge of. What they want to participate in is things that affect them the most, the direct job. That is what they have the most knowledge of.

I have no problem with your point. That is what productivity sharing is all about, whether you are talking about impro-share programs, the Scanlan plan or Rucker plan, all of these plans involve participation on a limited basis in terms of the workplace. So I agree, that limited partnership is a very good clarification.

Mr. **Brown**. I find interesting the comments of an earlier witness regard the success of codetermination; that is, worker participation on boards. It apparently has not revolutionized productivity, neither has it had the wholehearted support of labor. This is particularly true in this country. Labor seems to have shied away from enthusiastic participation, apparently wanting the benefits of increased productivity, but not wanting to take the responsibility for the management that might lead to losses.

Mr. **Usilaner**. Yes, sir.

Mr. **Brown**. I think that the focus will have to be upon a program that would educate workers and worker organizations as to the most desirable role that they can play in this productivity improvement equation.

Mr. **Usilaner**. Yes.

I guess the court is still out on the effectiveness of the employee stock option programs, but a limited study GAO did did not find any direct relationship between those programs and improved productivity. This just underscores your point.

Ed, do you have anything to add to that?

Mr. **Fritz**. I am a little troubled by the idea of the concept that the employees don't have a desire to participate. One of the things that I think has occurred over the years is that employees have been hired for their muscle and not for their brain so long that they have looked at it in no other way. Now, in the real production environment, you find the worker seeing virtually no relationship between what he is doing and the paycheck he gets. None. This then has happened in middle management and higher management levels.

So the whole concept of participation is to get the employee closer to what he or she is there for, and that is for the business to make a profit. Capital gains taxes, for instance, have had a tremendous amount of influence on the way management thinks in terms of capital investment and for good reason. Now they can afford to take the risk. Well, there has been no corollary as far as I know in terms of helping the workers see the relationship between what they are doing on the line and the paycheck they are getting.

Mr. **Brown**. Well, I am not belittling the need to improve the education and comprehension of management. I think it is an essential part of this philosophy that the responsibility has to be shared by both worker and management. In my opinion both sides display a lack of concern, the impacts on the community; both the local community in which the workplace is cited, and the national community where economic activity has a direct bearing on the national welfare.

We sometimes see very shortsighted views by both labor and management on how the enterprise affects the total national society except those cases where it affects personal profit. It seems to me we need some greater emphasis upon that particular aspect of the problem. I want to be very concrete there. An awareness of the role of an enterprise in the total national welfare can be an element in productivity.

Thank you, Mr. Chairman.

Mr. **Lundine**. Mr. Walgren.

Mr. **Walgren**. I want to ask why, in your view, is this National Productivity Council just fading away and disappearing? It would seem to me that, as you say, the problem with the Federal Government is a lack in focus of effort.

Mr. **Usilaner**. That is right.

Mr. **Walgren**. The only element that I see that has a particularly coordinative or private sector mandate that would give it the ability to focus anything, would be this National Productivity Council.

Mr. **Usilaner**. Right.

Mr. WALGREN. And yet, apparently they are not effective. Why is that?

Mr. USILANER. Well, a few reasons. This Council that was established was established by Executive order by the previous administration. They had good intentions. The chairman was the Director of the Office of Management and Budget in order to assure a link between budget and productivity programs the Federal Government undertakes. But as usually happens, the Council got lost in the shuffle. Other things came up. There was no sense of accountability. Pretty soon, members of the Council, which were all Government officials with no participation from the outside, started to send their replacements. At the end—there was an effort to regenerate something, but it was too late.

This administration now wants to reinvent its own wheel. They didn't even know that the old productivity council existed. We told them that if they were considering establishing such a council, they better first do away with the existing one. This administration now is toying with the idea, we understand, of setting up a productivity commission made up of business, labor, and Government officials. The last that we heard, that announcement was supposed to take place sometime after Labor Day. We have heard no more about that.

There has been in every administration over the last 10 or 12 years, a recognition that you need a focal point. There is a big effort to establish the focal point, but in an organizational sense only. After that, there is no followthrough at all, I can't explain it. We talk to the top officials in all the administrations. They see the importance, they understand the awareness. Then the push gets lost in the shuffle with all the other things.

Yet, we have found case after case of overlap and duplication and a lack of coordination among the various Federal agencies in the programs that they are undertaking to improve private sector productivity. But we feel that Executive order is not the answer. There has to be legislation. Mr. chairman, you understand that there will always be this stop and go and lack of institutional organization without legislation. There is no accountability to the Congress because there are no funds directly involved. They just tell the Congress we established this and we are doing all these great things. Everytime Congress holds hearings, that is the case.

Even though this administration realizes the need for a focal point, we still believe legislation is required.

Mr. LUNDINE. If I can—if you would yield on that point, you made several really important points there about the Productivity Council. First of all, accountability.

Second, I don't think you stated it precisely this way—there has to be a commitment by the administration.

Mr. USILANER. Yes; a strong commitment by the administration is essential.

Mr. LUNDINE. The exercise during the Carter administration was frankly a copout. They were trying to get rid of the old Productivity Commission that hadn't worked very well, as the GAO report indicated. But they didn't really have a commitment. I think you have to almost look back to the Ford administration, when at least for a while Vice President Rockefeller was really interested.

Mr. Usilaner. That is correct.

Mr. Lundine. They funded projects like Maccoby's down in Tennessee.

Mr. Usilaner. They also funded labor-management committees and issued several reports on QWL projects that enhanced productivity.

Mr. Lundine. I couldn't agree with you more that what we need is legislation, but somehow, we have to get the Congress and the administration together on what essentially is not a philosophic or partisan problem. We are interested in all of your analyses. I know the former Comptroller General is a strong supporter of a bill for another productivity council. Personally I don't care what we call it.

Mr. Usilaner. I agree.

Mr. Lundine. It is just the commitment and accountability that you pointed out that is so important and there has to be private sector people involved. If just Government people are talking to one another, it isn't going to amount to much.

Mr. Usilaner. Exactly. That is what I meant. We tend to solve a problem by establishing an organization. After that, there is no substantive commitment. If you track back from when there was a national commission—I guess in 1970—to now, here is an organization that is going to do the job. After that, there is no commitment or involvement of the top people.

Mr. Lundine. Excuse me.

Mr. Walgren. That is a good finish to the point.

Thank you, Mr. Chairman.

Mr. Usilaner. We will continue to try to push, and I think one of the ways we can get action is to continue to point at overlap, duplication, missed advantages and so on in a lot of our work. That is one of the things we are trying to do in our robotics assignment.

Mr. Lundine. I didn't mean to exclude the Banking Committee, which will get a copy of your testimony on this point.

Thank you.

Mr. Usilaner. Thank you very much.

Mr. Lundine. Now I would like to recognize Mr. Yawata, who has been kind enough to join us. He is the president of NEC Electronics, USA, and chief executive officer of that firm. He previously was the general manager of International Electronic Devices Division of Nippon Electric Co., Ltd.

We are very, very delighted to have your testimony. A great deal of attention is given to the failures of the United States compared to Japan in the areas we are interested in. We hope that your country has benefited to some extent, or that Japan at least has benefited to some extent from U.S. experiences, and now we can benefit some from your own experiences.

We have your testimony and your entire statement will be made a part of the record. If you would proceed in any way you see fit, we would appreciate it very much.

STATEMENT OF KEISKE YAWATA, PRESIDENT, NEC ELECTRONICS, USA, INC.

Mr. Yawata. Thank you, Mr. Chairman, members of the subcommittee, and ladies and gentlemen.

As I was introduced, I am the president of NEC Electronics, USA, Inc., headquartered in California, which deals with the manufacturing, engineering, and marketing and sales of semiconductor products and other electronic components in the United States. I joined Nippon Electric in 1958, and since then I have been engaged in the development of semiconductor products, manufacturing process engineering and the manufacturing and marketing products. I studied at Syracuse University in Syracuse, N.Y., for my masters degree in 1961 and 1962 as a Fulbright scholarship student. I was also under the David Sarnoff program, sponsored by RCA during this period. I am thankful for Senator Fulbright and the late Mr. David Sarnoff for giving me the opportunity to know the United States.

I would like to briefly describe what Nippon Electric Co. does. It was founded in 1899, and its headquarters are in Tokyo, Japan. There are over 64,000 employees and consolidated revenues for the 1980 fiscal year ended March 31, 1981, were $4.8 billion. The company's growth in the 1972-81 period averaged 14.3 percent a year. There are 70 sales offices in Japan, and 52 around the world—and 36 manufacturing plants in Japan, and 15 around the world.

The company consists of six business groups:

One. The switching group, which deals with telephone switching systems and telephone equipment.

Two. The transmission and terminal group, which deals with carrier transmission systems and terminal equipment.

Three. The radio group, which is responsible for the development and manufacture of microwave communication equipment, including satellite communications.

Four. The information processing and industrial systems group, which is a computer group.

Five. The electronic device group, which has the responsibility for semiconductor and other electronic components.

Six. The consumer electronics group, which develops, manufactures, and markets TV's and other consumer electric products.

I am associated primarily with the electronic device group.

These six groups are centered around research and development laboratories, and each group consists of several business units. About 36 percent of consolidated fiscal year 1980 sales was in telecommunication products; 24 percent was in EDP and industrial electronics systems; 25 percent in electronic devices; 13 percent in consumer electric; and 4 percent miscellaneous.

My testimony today consists of four parts:

One. The background of industrialization in Japan.

Two. The transition from copycat to leader in VLSI technology.

Three. Productivity.

Four. Education.

First, I will brief the background of industrialization in Japan. For 300 years, during the Tokugawa regime, Japan was practically closed to the rest of the world. There was only one port, Nagasaki, on the island of Kyushu, which was open to the world, and even a limited amount of trade gave Japanese scholars some idea about the medical, astrological, and technological progress in Western Europe. Therefore, hunger developed among these scholars. When the Tokugawa regime was overturned and Meiji government was restored, the hunger for knowledge exploded.

Because of the need for rapid industrialization, the Meiji government took the initiative for modernization rather than leaving it up to the private and public corporations. The government encouraged importation of technology and manufacturing equipment during the Meiji period and it was pure imitation of the original technology developed in the United States and European countries.

However, Japan started to develop her own technology in order to adjust matters to the Japanese environment. It is a special Japanese characteristic to reinvent and add improvements to original technology.

An educational system was developed in the early stages. Many engineers were trained to absorb Western technology as well as to develop their own.[1]

The tense situation during the 1920's and 1930's forced Japan to develop its own technologies rather than import them, because external pressures isolated the nation from the rest of the world. However, in that period, Japanese technology was sufficiently strong so the nation could develop its own military weapons, including aircraft and warships.

The heritage of the Samurai spirit is that the tougher the problem becomes, the harder people will attempt to solve it. When World War II ended in 1945, Japanese industrial production stood at 30 percent of the prewar level, as industry became exhausted. Agricultural production was 6 percent; real gross national product, 50 percent; real wage, 30 percent; and real consumption per capita only 6 percent of their respective prewar indicators. The inflation rate was 100 percent within 6 months following August 1945.

The chaos was overcome with the cooperation of the occupation forces, the Japanese Government, and the public companies. The Japanese economy steadily grew over the fifties, sixties, and seventies, though there were a few recessions from time to time. Gross national product grew over 40 times in 25 years since 1955. The gap in the GNP of the United States and Japan was approximately 16 times in 1955 in favor of the United States, of course. It became a mere 2½ times in 1980.

Many factors contributed to the rapid growth, such as demand for war supplies during the Korean war, capital expenditures to increse manufacturing capacity to meet new consumer need, and building the infrastructure across the nation, among others.

So far as the electronics industry is concerned, the portable radio, monochrome and color TV, calculator and quartz watches in the consumer sector, and electronic telephone switching, computer, automated office equipment and robotics in industrial sector, have been the stars, among others.

Second, I will analyze how the transition took place from a copycat to a leader in VLSI technology. The original technology for most, if not all, of these products was developed in the United States and transferred to Japanese industry. As Japan demonstrated in the early stages of industrialization, technology introduced to the country was improved and refined, and new products were developed and marketed.

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[1] The Japanese determination to be competitive in the international environment has always been great, as demonstrated in recent years during the energy crisis.

When color TV was introduced to the consumer market, the quality of the image improved rapidly primarily because of the high cost of the set. Consumers expected costly items, such as color sets, to have high quality, and so manufacturers ran a quality race among producers of components. This quality concept later led them to what is called "PPM quality," meaning that defects are measured in parts per million rather than in percentages.

Since there is no defense industry to speak of in Japan, the country's electronics industry was developed primarily around consumer goods.

The semiconductor industry played a vital role in automation and quality improvement. During the fifties, the transistors replaced vacuum tubes; in the sixties integrated circuits replaced transistors; and during the seventies LSI's, meaning large scale integration, became the star of the electronics industry.

Although it is true that during the fifties and sixties the semiconductor technology was transferred by American companies to Japanese manufacturers, much of the LSI and VLSI process technology development was done by Japanese manufacturers during the seventies. In that period, the calculator industry demanded large helpings of MOS LSI from the domestic supply. The television industry also accounted for a great deal of the volume consumption of integrated circuits.

Technical breakthroughs were sought in the United States and Japan without much success. Meanwhile, the computer industry demanded more memory and data processing capacity. The Japanese computer and semiconductor manufacturers sensed this demand, and made cooperative efforts with the support from MITI—Ministry of International Trade and Industry—to develop fine pattern technology to increase the scale of integration on a chip of silicon.

There was no sample to copy, nor technology in the United States to be transferred. No single public or private corporation could afford the resources required to develop VLSI technology in 5 years, especially the human resources. It is my personal belief that Japan built a national consensus of having caught up in certain technology sectors with the United States, and it is this consensus, together with the confidence among the scientists and engineers that made such cooperative projects successful.

It is also worth noting that the spirit of cooperation is needed in the mind of the Japanese during childhood, as will be explained later.

Third, I would like to discuss productivity. During the sixties and early seventies, when many American semiconductor manufacturers manned assembly bases in Southeast and Far East Asia with cheap labor, Japanese manufacturers turned to automation and found that not only was labor content minimized, but the quality was improved also. Human error was hard to predict but machine error is made repeatedly and it is easy to correct. Therefore, automation gave uniform quality to Japanese semiconductor industry.

There was a time, especially during the fifties, when Japanese products were known for their inferior quality. However, Japan turned around almost 180° and started emphasizing the importance of the quality of product built by its manufacturers. A nationwide campaign to improve quality was made. Quality control was pursued, not just by introducting a quality control department into the organization, but by introducing the entire work force to the phenomena and explaining why quality control activity had to be practiced.

For example, when the Nippon Electric Co. introduced the "zero defects" movement, it spent the first 2 years preparing for the company-wide program. The new system was actually introduced only after the entire population of the company had understood what the "zero defects" program was, and committed themselves to it.

During the 2 years for preparation, many lectures were given to top and middle managers and the objective management method was experimented. By the end of the 2 years, each employee had understood what was good for the company was good for them on a long term, and a small group QC circle system was ready to take off.

After product quality was successfully raised to internationally competitive levels, or exceeded those levels, Japan did not relax its efforts but intensified them to reduce the cost of manufacturing. Thus, the programs to promote value engineering and value analysis methods through which all employees and managers of companies could make contributions to cut material costs or improve performance, were imbedded in Japanese industry.

What is important in this program is that the reward for achieving cost reduction is the recognition by the fellow workers. A certificate of award is posted on the wall for recognition, therefore, the program did not create extra cost. Again, what was good for the company was good for the employee.

Lastly, the education aspect is discussed. Japan does not have many mineral resources. The only natural resources it has are people, and it is taught to the children of 7 to 12 years of age in school. Perhaps it is this threat that drove Japanese companies to continue to increase their competitiveness in the international marketplace.

In the initial stage, labor unions resisted participating in productivity improvements or cost reductions, particularly by way of automation. However, as soon as they were convinced that improvements in productivity did not result in unemployment, labor unions started to cooperate actively in this area.

Since most of the efforts to improve quality and productivity were made during the sixties and seventies, when the economy was growing rapidly, it was possible to use the surplus labor to greater advantage elsewhere, and increase the overall growth.

When the economy slowed, excess labor was retrained for other jobs. For example, from manufacturing to sales and marketing, or from manufacturing to product distribution. Therefore, productivity improvement was understood by the workers as an opportunity, rather than as a threat, because they never lost the opportunity for employment.

Japanese corporations were able to successfully improve productivity without creating fractures in the labor market, largely because of the training and education given to the people. Japanese children are taught at home and in school to be cooperative. In other words, more stress is placed on cooperation with other people than on individualism, and uniqueness is not emphasized. Children are taught to work hard, and much homework is handed out. School hours are longer, and more quizzes and tests are given, so that a sense of competition is created when they are young.

Because of the shortage in technical resources, corporations are making efforts to increase the electronic engineering population by providing courses in electronic engineering, computer science, et cetera, in order to retrain their employees, besides hiring new electronic engineering graduates.

As a result of strong emphasis in electronic engineering given by these corporations, there are twice as many electronic engineers per million population graduating from universities and colleges in Japan as in the United States. It is vital for the electronics industry, in surviving the international competition, that the electronic engineering degrees are promoted more than other fields of study.

In summary, the majority of the Japanese population is educated and trained to work hard and be cooperative with other people, which enables Japanese companies to maintain good relations with labor unions and workers in the country's long run to catch up with the rest of the world under a handicap of 100 years' lag.

Once again, the lack of natural resources other than people has given Japan a great sense of threat, but it has also contributed to the making of extra efforts, sometimes beyond those of Western nations. These are the factors which have contributed to improving productivity, which in turn, is inflation's worst enemy.

Whether Japan can continue to make rapid improvements will depend a great deal on its success in finding the methods to educate and train more creative people. As Americans like to say, we are going to give it our best shot. We know you will be doing the same. Good luck to all of us, for the sake of the entire world.

Thank you.

Mr. LUNDINE. I must first start out by saying that you are doing pretty well, given a 100 years' lag.

Mr. YAWATA. Thank you, Mr. Chairman.

Mr. LUNDINE. First of all, throughout the testimony we have received this morning from a number of witnesses from a number of different perspectives, the point has been made that the improvement really is a process, and that you concentrate on small improvements as you go along, and as a result of that, great gains are made.

Do you think that that is a fair statement with respect to your experience in Japan, both in improving product quality, and in productivity?

Mr. YAWATA. Yes, I think it is a fair statement. As we say in Japan, even the dust, if it accumulates, could make a mountain. So small efforts in many areas can result in great improvement in productivity.

Mr. LUNDINE. Second, I am interested in your comments about job security being the key to productivity improvement and to getting union cooperation in your country. The difficulty is how to deal with the down side of the industrial process.

We are living in a very competitive world. No country is going to escape having some industries that are impacted. Could you give us a little more information about the retraining program? Specifically, if a worker is in an industry that is declining in Japan, how is he transferred over to another sector? And does that usually mean he has to move, change locations? And how is that handled in Japan?

Mr. YAWATA. Yes, in some cases it involves relocation. When one of the shipbuilding operations was closed, they sent their employees to the other side of the Japanese island to work for another company on a sort of loan basis. They did not fire them, but they loaned the labor to another company. Of course, they received a wage from that company that they worked for, and were on loan to.

That is an extreme case, but usually the workers do not belong to the trade union, but company union—the Japanese labor union is a company union that is formed within the corporation. Of course, they have associations. So similar types of companies, or a union of similar types of companies form an association of unions, and they do communicate. But they are not organized according to the trade or skill, therefore, there is not much resistance to change the type of job.

For example, mechanic to electrician. So I think it is a benefit of the Japanese labor organization not to have divided by trades or skills. Usually, the company provides courses in the evening which employees can participate free of charge for a period of 6 to 12 months, and receive a certificate of completion of a course, and this promotes the training, self-training in different areas than his own expertise.

Mr. LUNDINE. How can the lessons of the Japanese experience be applied to the U.S. industrial environment?

Mr. YAWATA. That is something that I have to experiment in the next few years in my own company.

Mr. LUNDINE. Maybe we will ask you to come back.

Mr. YAWATA. But I think it is dangerous to transplant the same thing from Japan into the United States, where the environment is entirely different. So I think I need to understand the background of the American labor situation and management before I do anything about the Japanese style of management.

Usually we spend the first 2 years without doing anything. It appears we are doing nothing. But on the back of the scene, we try to make people understand what the objectives are and what can be done to realize the objective by changing the method of management.

In other words, we go through the change step by step, and very slowly, but steadily. So I hope we can do that in the environment of California, too.

Mr. LUNDINE. As an aside, I would be amazed if your incentive system of having certificates go up on the wall for a good employee is a great motivational factor in California.

Mr. YAWATA. I think that will take at least 20 years to implement.

Mr. LUNDINE. That gets to education. Could you give me a little more information about the difference in educational systems, that is to say, how is cooperation stressed to a greater degree in the educational system in Japan than here?

Mr. **Yawata**. First of all, small kids, before going to school, are taught to work with other people. The mother often tells her child to look at his friend, what he is doing and not to be different than other kids. A child is taught to be similar, or to do whatever other kids are doing.

I think that is the opposite of making a kid creative. So I think there is a danger there. But at least the sense of cooperation is taught to the child that way.

In schools, there are more group activities than individual activities. I am not too familiar with the American elementary school system, but the class I have seen was entirely different from the class in Japan.

Every child is reading a different book, or every child is doing different in some school hours. And that does not happen in the Japanese systems.

In other words, they are a more group-oriented class than individual-oriented class. So this is the kind of training Japanese children receive to learn to be cooperative with other people. Doing the same thing as other people is a part of the cooperation.

Mr. **Lundine**. Finally, I want to share a thought with you. You conclude by mentioning that a great sense of threat, because of a lack of natural resources, is a motivating factor in Japan.

Several of the other witnesses have mentioned that you can accomplish something in a crisis that is very hard to do in an anticipatory way.

I thank you for providing us with the threat that we need to get our attention.

Mr. **Yawata**. You are welcome, Mr. Chairman.

Mr. **Lundine**. Mr. Walgren.

Mr. **Walgren**. How long have you been managing your division here in America?

Mr. **Yawata**. As president of the corporation, I have been with this company, which is a subsidiary of NEC, for only 4 months, since April of this year.

Prior to that, I was sort of remotely controlling the division from Japan.

Mr. **Walgren**. How long has the division been operating here?

Mr. **Yawata**. The first division was organized in 1975. The newest division was acquired in 1978.

Mr. **Walgren**. And in those 6 years, what are some of the significant differences in worker attitude that you have seen between your American and Japanese workers? What's been your actual experience with American workers compared to your experiences in Japan?

Mr. **Yawata**. It is hard to generalize, because we have a division in Massachusetts which is in the east coast culture, and the other division in California, which is a west coast culture, so I cannot generalize it.

But in general, I would say that the Japanese-style management, or Japanese-flavored management, has been welcomed by the employees.

Of course, we had a lot of argument about the Japanese versus American management. Oftentimes we compromised.

Mr. WALGREN. Can you explain what you mean when you say Japanese-style management——

Mr. YAWATA. Primarily I mean consensus management. Rather than having the president or department manager making a unilateral decision, and the people have to implement the decision, whether they like it or not, the consensus management—as is also practiced by many Americans, so I don't think it is fair to call it Japanese-style, but it is practiced primarily by Japanese, all of Japanese companies. And I define it as Japanese management.

So it is the consensus method among the concerned managers and one level lower management. We discuss the subject. And before we reach a conclusion or make a decision, everybody makes contributions to the discussion.

Everybody has to give in a little bit to arrive at common agreement.

Mr. WALGREN. Have you sensed a greater degree of security in your American workers than their counterparts in other companies?

Mr. YAWATA. I would say we have fewer turnovers than in our competition, American counterparts.

Mr. WALGREN. Is there any way of measuring that?

Mr. YAWATA. I have not taken the statistics. But, for example, in our California division, our annual turnover is somewhere near 15 percent, which is very low.

Mr. WALGREN. Why do they turn over?

Mr. YAWATA. Well, in California, there are natural mobility of people. For example, if the husband moves, the wife has to move. So there are natural mobilities rather than some dissatisfaction of the job.

Mr. WALGREN. So your experience is primarily a voluntary decrease rather than an imposed cutback in the work force?

Mr. YAWATA. We never cut back our work force.

Mr. WALGREN. Have your competitors cut back their work force?

Mr. YAWATA. I can speak only about the semiconductor industry, but there has been some layoff recently because of the economy. But some companies like Texas Instruments reduce the work hours rather than laying off people.

So there are two kinds of managements, I think.

Mr. WALGREN. Is it an expressed policy that you never cut back your work force?

Mr. YAWATA. Yes, it is.

Mr. WALGREN. I am interested in your discussion of the labor organization in Japan being organized on a company basis, as opposed to a trade basis. That fits, with the earlier comments about attempts to broaden job identification; so that one would identify and hopefully apply their skills to a broader array of tasks.

It seems to me this is an aspect of your culture in Japan.

Mr. YAWATA. It could be called a part of culture, but the labor union is a manmade organization, so I think it can work to the advantage of the workers themselves.

The only trade union that I know of in Japan is the National Railroad Union, which is organized according to the type of work.

That is a large union, but other than that, I don't know of any other trade unions.

Mr. WALGREN. I know you came to study at Syracuse after you joined the parent organization.

Mr. YAWATA. Nippon Electric, yes.

Mr. WALGREN. That is relatively unusual in this country. It is not unheard of, but it is relatively unusual. The identification of the individual with the overall progress of the company or firm with which he works, is almost nonexistent in this country.

Mr. YAWATA. I wouldn't say so. I have a brother who worked for General Electric, Fairchild and Hewlett Packard. I think this career record can be very good.

I think people realize the record, the work or job record, if it is a good one. Was that your question?

Mr. WALGREN. That is an interesting comment. Do you feel that in American management, both in terms of the view of their own recognition within a company, and also their ability to recognize labor or other people's contributions, one progresses truly on merit?

Mr. YAWATA. I think the Japanese people are more oriented toward recognition than material income or wage. I think I testified also about the award being posted on the wall, as Mr. Chairman laughed at.

But in general, the recognition is more respected in Japan than in this country. But here also, if you go to military service, award is recognized.

So I think it is a part of American culture, also.

Mr. WALGREN. If the greatest strengths that you have experienced under the Japanese system could be transferred to your company in California, what would that resulting company look like? And what would the attitudes of its workers be?

Mr. YAWATA. We are a semiconductor company, and the legal entity in this country is very small. Now I think it is a problem of a small semiconductor electronics company in this country because of the lack of financial support. But leaving the large Japanese parent corporation aside, I would like to establish a long-term employment, steady work force with respect for each other, just like in large corporations like General Electric, or Westinghouse, Western Electric have established over 50, 100, 150 years time frame.

The small companies in this country are more entrepreneur oriented. They must grow fast, are performance- or revenue-oriented, rather than management-oriented.

I would like to create a company which is management-oriented and people are interested in working together. That is the image I have of the company.

Mr. WALGREN. Well, it is so hard to compare the two, because our societies have started out from such different points. But it is interesting that you mention first long-term as a priority.

And your primary emphasis is on giving something to the employees, providing something to the employees of real value. That is not the first thing most American business enterprises would mention. There is sort of a devil-take-the-hindmost approach in our society.

And that approach seemingly is based on personal achievement which we somehow believe enhances the common good.

But it is only indirectly that the common good is genuinely enhanced in the American value system. I remember the president of General Motors, being asked on "Meet the Press," what his greatest problem was. He answered, "if only my employees would come to work half the time, I would have no problems." After a 20-minute discussion on the aggregation of OSHA and governmental interference, when asked what his real problem was, it was that his workers wouldn't come to work.

And underlying that is just basic human nature. Obviously, it is much more conducive to somebody coming to work when that person benefits from it. We, in this country apparently are not developing that sort of relationship.

The relationship which you in Japan have developed has apparently solved one of our major problems. If we could only go along that road, we could go far.

Mr. YAWATA. I am not saying that the profit or bottom line is not emphasized in Japan. It is. But having good relationships and having employees cooperate with each other, results in profit, because everybody gives in with the belief that what is good for the company is good for them.

Mr. LUNDINE. I want to ask a follow-up question to the one Mr. Walgren raised. What you call consensus management we tend to call worker participation. I think it amounts basically to the same thing. You talked about how it was threatening managers particularly in the United States.

My experience has led to the same conclusion because managers in a participatory system can be in effect, second-guessed. And they are not used to being second-guessed. Participation suggests that workers at all levels are going to have ideas and they are going to be evaluated on merit, not on some kind of a hierarchy alone.

Did you find that the people most threatened by this were the first level supervisors, the foremen in our factories?

Mr. YAWATA. That is the greatest difficulty we have found. We are not implementing the QC circle, or small group activities yet in our California factory.

We want to conduct a survey and give seminars and lectures to the employees so that they will understand what it means, and there will be no backlash from introduction of the new method.

So we are still studying the method of introduction of the new system. That point is the greatest concern of ours, that the supervisor is threatened by the workers.

So we have to make the supervisors understand that they will not be threatened. That is very difficult.

Mr. LUNDINE. It's interesting to me how you tend to study things, and how short the timeframe is. I don't think we need to look at just industry in America and a Congressman with a 2-year term understands what a short timeframe is.

Mr. RHEEM. There seems to be agreement that America does not need a retransplanting of what was initially American ingenuity back from Japan. But rather, a renewed vigor in American management, in order to critically examine the forces affecting the productive processes and adaption to forces, is what is needed.

Assuming there was a lull in the time in which American managers were innovative, what do you think might have caused that lull in managerial creativity. Also, how might we set up a system of programs in the American economic environment, that would encourage managers to be more innovative?

Mr. YAWATA. I don't think there is a very simple and easy answer and ways. But as Japan spent a great deal of the 30 years after the war in studying what the American method was, management and quality control method was, and fitted them into the Japanese environment, and we did not have the answer upfront.

We had to study and change, modify the methods to fit the Japanese work environment. So I would say the same thing applies here. I have no answer, no clear answer right now.

But I am sure answers can be found in due time to continue to be a leader in industry in the world. I am sorry, I can't give you a quick and clear answer.

Mr. RHEEM. Do you think the answer is more likely to come through action from the Federal Government, or from industry itself?

Mr. YAWATA. I think the Government's role in this regard is to help the companies obtain more resources, both in technical and engineering, and managerial. To be creative, to create creative people needs a lot of study as to what age the kids find interest in scientific or otherwise subjects.

So this research and study on education can be a great help to the industry. So far as management is concerned, I think each corporation has to do its own studying. I don't think there is a general management course or practice that can readily apply to each individual company.

So that part, I think, is being done by various universities in business administration. So it just takes some promotion and encouragement to the American corporations to do their own managerial study within the corporation.

If textbook is the answer, I think everybody is successful.

Mr. RHEEM. Thank you. Thank you, Mr. Chairman.

Mr. LUNDINE. In conclusion, I would like to make several points.

Mr. Usilaner remarked that the conclusion of the GAO's study was that human resources, not superior technology, really made the difference.

Mr. Yawata has talked about the 2-year employee education program which preceded Nippon Electric's zero defects program. I want to share one other interesting experience.

I recently had the opportunity to attend an International Conference on Productivity in England. At that conferene, the operations vice president of Ford Motor Co. told me that technology investment really wasn't hurting them in matching Japanese car quality and price, but that the work organization difference was far more important in the lack of competitiveness.

The conclusion I would reach from today's testimony, the points I cited, that additional experience is certainly that human resource development is a key to economic success.

We look forward to the remaining hearings. We are going to have some tales of success, and some American examples where people actually do go to work and enjoy it, too.

Thank you very much.

[Whereupon, at 12:35 p.m., the subcommittee was adjourned.]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

THURSDAY, SEPTEMBER 10, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to notice, in room 2318, Rayburn House Office Building, commencing at 9:05 a.m., Hon. Stan Lundine (chairman of the subcommittee) presiding.

Present: Representatives Lundine, Brown of California, Walgren, Shamansky, Weber of Minnesota, and Schneider.

Mr. **Lundine**. The subcommittee will come to order.

Yesterday this subcommittee heard from some very interesting witnesses, commencing 6 days of hearings on "The Human Factors in Innovation and Productivity." Dr. Michael Maccoby gave us a useful orientation generally on this issue. Mr. Thorsrud from the Work Research Institute in Norway provided us with a glimpse of what one Scandinavian country has done in this area, as well as sharing his worldwide experience in the quality of working life.

Mr. Yawata, the president of Nippon Electric, told us of his efforts to transfer Japanese management techniques to American-based affiliates, and Brian Usilaner from the General Accounting Office gave us an excellent summary and background of the U.S. efforts in this area.

Today we have a rich variety of witnesses. I think I will introduce them as they are about to testify.

The first is Harvey Brooks, who is professor of technology and public policy at Harvard University. Mr. Brooks.

We have your written statement and it will, without objection, be made a part of the record. You may proceed as you see fit.

[The biographical sketch of Mr. Brooks follows:]

Harvey Brooks

My name is Harvey Brooks. I presently hold the title of Benjamin Peirce Professor of Technology and Public Policy in Harvard University. This is a joint appointment in the Kennedy School of Government and the Division of Applied Sciences. Formerly I headed the Division, then known as the Division of Engineering and Applied Physics, in the capacity of Dean from 1957 to 1975. Since 1960 I have also been associated with the Kennedy School (then the Littauer School of Public Administration, teaching along with Don K. Price and others the Science and Public Policy Seminar, founded by Dean Price in 1958. With Prof. Price's retirement two years ago I became responsible for the seminar and the Program on Science, Technology, and Public Policy in the Kennedy School. One segment of that program is the Program on Technology, Public Policy, and Human Development, endowed by Dr. Sidney Harman, and now directed by Dr. Michael Maccoby. I chair the advisory committee for that program.

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My interests in science, technology, and public policy have been diverse, including many aspects of "science policy", energy policy, technology assessment, and most recently the impact of technology on work organization and the quality of working life.

STATEMENT OF HARVEY BROOKS, BENJAMIN PEIRCE PROFESSOR OF TECHNOLOGY AND PUBLIC POLICY, HARVARD UNIVERSITY

Mr. BROOKS. Thank you, Mr. Chairman.

In the late sixties European political leaders became very alarmed over the alleged "technology gap" between Europe and the United States, and many studies and debates ensued on the origins and causes of this gap. A good many American observers concluded that the gap was not technological but managerial; that the principal American advantage lay not in the ability to generate superior technology or hardware, but in its capacity to match technology with markets and its ability to adapt its institutions and management methods to facilitate the application and rapid commercialization or diffusion of new technology, whatever its origins.

It is remarkable that a decade later almost the same things are being said once again, but now the United States has replaced Europe as the laggard, while Japan—and to a lesser extent, West Germany—have come to occupy the position formerly attributed to the United States. And once again the superior performance of the leaders is being attributed primarily to social and managerial innovation rather than superior capacity to originate new technology.

Both the technology gap of the sixties and the innovation lag of today represent partial and oversimplified perceptions of complex situations. Yet I believe that the emphasis in both cases on the social and managerial dimensions of the gap is justified. Almost any technological innovation that has a major impact has a social dimension which involves the invention of novel institutional arrangements, new legislation, new managerial techniques, and new marketing methods or some combination of these.

The social inventions required to make technological innovations succeed in the marketplace or be adopted politically are frequently referred to as "supporting systems." It is often these supporting systems that are responsible for the social effects of technology, more so than the hardware. The supporting systems, furthermore, are not uniquely determined by the technology, but can be quite varied, depending on the particular political and social environment or traditions into which the technology is introduced—or even on the imagination of the inventors.

A good example is the television broadcast and reception system that has grown up in different countries, ranging from public monopolies supported by license fees on receivers to the advertising support system with which we are familiar in the United States. A good example of a social technology in connection with this supporting system is the system of audience ratings, which has had a profound influence on the programing of TV in the United States.

Flexibility with respect to the social supporting systems that accompany new technology is particularly characteristic of information technologies, perhaps especially those that have not yet been applied on a large scale, such as office technology. This flexibility is much greater for information technologies, in my opinion, than for the more traditional mechanical technologies which are the basis of much traditional manufacturing. This flexibility may constitute both an opportunity and a threat in relation to the social effects of new office technology, with the consequence that more deliberate and self-conscious attention to supporting systems in respect to their human implications will be much more necessary perhaps than in the case of past innovations.

In the past, these inventions of supporting systems have often been accidental and intuitive, almost accidental byproducts of the introduction of the hardware itself. The emerging information technology unfortunately provides the first true opportunity for the "taylorization" of office work with the same thoroughness with which it was applied to the mechanical assembly line in the past. But it also provides the opportunity for removing much of the drudgery and routine from offices, and this will be almost entirely dependent on the kinds of supporting systems that are devised to go along with the introduction of this technology.

We can distinguish four broad areas of social innovation which may accompany the introduction of new technology on a wide scale. I will classify them as market, managerial, political, and institutional.

These classifications are inevitably somewhat overlapping. For example, market, managerial, and political innovations all may include the creation of new institutions. But here I use the term market innovation to refer primarily to innovation at the interface between the producer and user, to social inventions designed to expedite wide diffusion and acceptance of technological innovations, creativity in re-defining user needs, and, in fact, in identifying new needs.

By political innovations I mean social or institutional innovations that involve substantial government intervention for their implementation, whereas by institutional innovations I refer to more decentralized initiatives originating outside of government or the legal system, such as voluntary coalitions or citizen groups or entrepreneurial small firms.

The debate today surrounding the restructuring of both the data processing and telecommunications industries in order to accommodate to the revolution in both technologies is an example of a struggle to reach a political consensus on the optimal supporting systems to fit the new technologies that are in the offing and the new services that they make possible. Because some of these industries are regulated, the problem, in fact, becomes particularly a political one.

A fundamental problem of the introduction of new technology is that its benefits and adverse effects are unequally distributed. Thus, even when the aggregate social benefits of a technology exceed its aggregate costs, some groups and interests may experience net costs. Furthermore, these net costs may be experienced by particularly vulnerable groups—for example, particularly sensitive subpopulations in the case of air pollution, or elderly workers with obsolescent skills in the case of industries declining because of the introduction of new technology in competitive industries.

A production technique that results in equivalent goods or services being produced with a smaller input of resources in the form of capital, labor, materials or energy, is clearly a benefit to society as a whole, but for workers displaced by increased productivity without a corresponding increase in demand for the product, it may be experienced as a disaster, one that cannot be fully compensated by society, at least with our present mechanism..

Overall growth in productivity is partly the result of the shift of labor on the average from jobs with lower value added per unit of effort to higher value added, but the dislocation experienced by the individual or the failing firm is a cost that society has not yet found a way for compensating adequately. The lifetime employment system in Japan, and the de facto lifetime employment system which exists in many high-technology firms in the United States, is one response. But its viability in the long term is perhaps untested. In Japan, the system actually only exists in the larger firms and affects only about 25 percent of the labor force. There is also a question as to how dependent it is on the combination of rapid economic growth, high investment rates, and early retirement that has characterized that particular segment of the Japanese economy for more than two decades. How long can it be maintained under less favorable circumstances, with an aging labor force, declining growth rates, and rising energy and raw material prices? Nevertheless, it is clear that many Japanese firms and, for that matter, the most progressive American firms, treat their people as human capital—to be maintained, developed and improved as a long-term investment, rather than to be treated as a dispensable variable cost.

The question of job security looms large in relation to the introduction of new technology, especially in a time of slow growth such as we are experiencing at the present. Where technology is changing rapidly, security in particular job functions is the most difficult thing to maintain. Thus, within the firm, job security can only be achieved in practice if there is the opportunity for high mobility and rapid acquisition of new skills by existing employees. This is the human capital approach I just referred to, which seems to be characteristic of the successful Japanese firms and the most progressive American firms.

I might also note in passing that this approach within the firm probably also greatly increases the employability of the individuals involved in other firms.

But there are many industries, typified by bulk steel, automobiles, shipbuilding and petrochemicals in which world-wide overcapacity is developing because of a combination of market saturation in the developed countries with the desire for indigenous manufacturing in the developing countries. Because of higher wage levels in the developed countries, they can only retain their share of a slowly growing market by rapid improvement in productivity through technology and work organization. This implies, I think, an inevitable reduction in the total number of jobs in their industries. The layoffs already experienced in these industries which I cited are likely to become permanent in many cases. Furthermore, the somewhat easier present situation in Japan may prove temporary. Any policy of job security is likely to be severely challenged in these particular industries worldwide, as we are already seeing in some cases. It is a challenge to political and other institutions to expedite mobility and retraining of people out of these industries into more rapidly growing ones, including those offering entirely new products or services. Clinging to traditional industries for purposes of maintaining employment is likely to be self-defeating in the long run. Even if employment is temporarily sustained by subsidies or by protection, it will retard growth in other areas of the economy and make the ultimate adjustment problem more traumatic because of the lack of opportunities elsewhere in the economy.

We are also seeing a worldwide trend toward disenchantment with bureaucratic organizations with highly fractionated job responsibilities and elaborate systems of hierarchical controls. It is interesting to observe that this trend is occurring simultaneously in capitalist and socialist countries. There appears to be much in the program of Solidarity in Poland that finds echoes in experimentation with self-management and industrial democracy in many of the major capitalist countries.

The future of all this is not entirely clear at the present time. Bureaucracy, but also the more thoroughgoing types of worker democracy, both appear to introduce rigidities into the economic system which can lead to retarded growth and imperfect adjustment to technological change, including changes in international competitiveness induced by the rapid diffusion of new production technology in today's tightly interdependent and communicative world. It seems clear that bureaucracy in both Government and industry is on the defensive, if not on the skids, but what will replace it is not entirely clear. What seems to be required in the present situation is vigorous and diverse social and political experimentation, many examples of which have been described and will be described in these hearings.

It may also be true that the shift in emphasis in technological innovation will be from labor saving to capital and resource saving technologies. We are already seeing this in the field of energy, but it is apparent also in resources and capital. An example of the latter is the use of robots to reduce the idle time of expensive machines. An example of the former is the use of information technology to reduce energy consumption in buildings, transportation, and factories, including the substitution of information transfer by telecommunications for travel and the use of data processing to manage inventories. In all of these areas, software invention—where software is used in a very broad sense, not just computer software—may be more important than hardware.

Thank you.

[The prepared statement of Mr. Brooks follows:]

STATEMENT OF HARVEY BROOKS, BENJAMIN PEIRCE PROFESSOR OF TECHNOLOGY AND PUBLIC POLICY IN HARVARD UNIVERSITY

In the late 1960's European political leaders became very alarmed over the alleged "technology gap" between Europe and the United States and many studies and debates ensured on the origins and causes of this gap. Many American observers concluded that the gap was not technological but managerial, that the principal American advantage lay not in the ability to generate superior technology but in its capacity to match technology with markets and its ability to adapt its institutions and management methods to facilitate the application and rapid commercialization or diffusion of new technology, whatever its origins.

It is remarkable that a decade later almost the same things are being said once again, but now the United StaTes has replaced Europe as the laggard, while Japan—and to a lesser extent West Germany—have come to occupy the position formerly attributed to the United States. And once again the superior performance of the leaders is being attributed primarily to social and managerial innovation rather than superior capacity to originate new technology.

Both the "technology gap" of the 1960's and the "innovation lag" of today represent partial and oversimplified perceptions of complex situations. Neither the American lead of the 1960's nor the American lag of the 1980's were as great or ubiquitous as alleged. Yet I believe the emphasis in both cases on the social and mangerial dimensions is justified. Almost any technological innovation that has a major impact has a social dimension which involves the invention of novel institutional arrangements, new legislaiton, new managerial techniques, new marketing methods.

The social inventions required to make technological innovations succeed in the marketplace or be adopted politically are frequently referred to as "supporting systems". It is often these supporting systems that are largely responsible for the social effects of technology, more so than the hardware. The supporting systems, furthermore, are not uniquely determined by the technology, but can be quite varied, depending on the particular political and social environment or traditions into which the technology is introduced. A good example is the television broadcast and reception system that has grown up in different countries, ranging from public monopolies supported by license fees on receivers to the advertising support system with which we are familiar in the United States. In fact the social technology that is probably most important for the social effects of broadcast TV is the audience rating system. Despite the different institutional and legal arrangements that exist for TV in different countries, the physical technology is essentially the same everywhere.

Flexibility with respect to the social supporting systems that it can accommodate is probably particularly characteristic of information technologies, perhaps especially those that have not yet been applied on a large scale, such as office technology. This flexibility is much greater for information technologies than for the more traditional mechanical technologies which are the basis of most manufacturing. As I shall indicate later this flexibility may constitute both an opportunity and a threat in relation to the probable social effects of the technology, with the consequence that much more deliberate and selfconscious attention to supporting systems in respect to their human implications will be necessary than in the case of past innovations. The emerging information technology provides the first true opportunity for the "Taylorization" of office work with the same thoroughness that it was applied to the mechanical assembly line in the past. But it also provides the opportunity for removing much of the drudgery and routine from offices.

We can distinguish four broad areas of social innovation which may accompany the introduction of new technology on a wide scale. I will classify them as market, managerial, political, and institutional. These classsifications are somewhat overlapping. For example, market, managerial, and political innovations may include the creation of novel institutions. But here I use the term market innovation to refer primarily to innovation at the interface between producer and user, to social inventions designed to expedite wide diffusion and acceptance of technological innovations. By political innovations I mean social or institutional innovations that involve substantial government intervention for implementation, whereas by institutional innovations I refer to more decentralized initiatives originating outside of government or the legal system—voluntary coalitions or citizen groups or entrepreneurial firms.

As an example of where market innovation is clearly required I would cite the services to be provided by broad band communications, including cable, optical fibers, and satellites that can transmit to home receivers at affordable cost. We are moving from a time when communications capacity was scarce and capital-intensive, and hence had to be politically allocated, to a time when it will be cheap and abundant, and increasingly accessible to more and more users at lower and lower cost. But what will be the services actually provided through all this information capacity? Clearly this is the domain of market innovation, a wide open field. But given the coming abundance of the information resource can we trust the market to arrive at the most socially productive use of information? To what extent will political intervention be required to avoid socially undesirable or corrupting uses of all this information? These questions suggest that, although market innovation will be the driving force in the application of this technology, political innovation may be required to nudge the market to capture the greatest collective benefits, and to avoid abuses.

An example of a situation where managerial innovation will be the salient challenge is the organization of offices to take advantage of new office technlogy while improving rather than degrading the quality of office jobs. Office technology represents a prime example of a situation where the supporting system is the key to whether the social impact of a revolutionary and potentially productive technology is positive or negative. Indeed the increase in productivity which could in principle result from this technology will not be realized in practice unless the quality of the work is humanly satisfying. Unlike the classical factory situation, offices cannot operate efficiently in a coercive policing mode; the cost of policing is just too high, and the opportunities for subtle sabotage too easy. The productivity of technology can only be realized in practice if all the participants cooperate and basically accept the goals of the organization.

An example of political innovation in response to a new technology was the creation of Comsat and Intelsat to manage international telecommunications by satellite. Most observers feel that these organizations resulted in a maximum rate of diffusion of the services that satellite communications made possible. Yet this system already appears under challenge as a result of newer technologies and the increasing desire of nations to operate national satellites, primarily for reasons of national prestige.

The debate today surrounding the restructuring of both the data processing and telecommunications industries in order to accomodate to the revolution in both technologies is an example of a struggle to reach a consensus on the optimal supporting systems to fit the new technologies that are in the offing and the new services that they make possible. Because some of these industries are regulated, the problem becomes a partially political one.

A fundamental problem of the introduction of new technology is that its benefits and adverse effects are unequally distributed. Thus, even when the aggregate social benefits of a technology exceed its aggregate costs, some groups and interests may experience net costs. Furthermore, these net costs may be experienced by particularly vulnerable groups—e.g. particularly sensitive subpopulations in the case of air pollution, or elderly workers with obsolescent skills in the case of industries declining because of the introduction of new technology in competitive industries. A production technique that results in equivalent goods or services being produced with a smaller input of resources in the form of capital, labor, materials, or energy, is clearly a benefit to society as a whole, but for workers displaced by increased productivity without a corresponding increase in demand for the product, it may be experienced as a disaster—one that cannot be fully compensated by society, perhaps. Overall growth in productivity is partly the result of the shift of labor on the average from jobs with lower value added per unit of effort to higher value added, but the dislocation experienced by the individual or the failing firm is a cost that society has not yet found a way for compensating adequately. The lifetime employment system in Japan, and de facto lifetime employment in many high technology firms in the U.S., is one response, but its viability in the long term is untested. In Japan the system actually only exists in the larger firms and affects only about 25 percent of the labor force. There is also a question as to how dependent it is on the combination of rapid economic growth, high investment rates, and early retirement that has characterized that particular segment of the Japanese economy for more than two decades. How long can it be maintained under less favorable circumstances, with an aging labor force, declining growth rates, and rising energy and raw material prices? Nevertheless, it is clear that many Japanese firms, and for that matter the most progressive American firms, treat their people as human capital—to be maintained, developed, and improved as a long term investment, rather than to be treated as dispensable variable cost.

The question of job security looms especially large in relation to the introduction of new technology. Where technology is changing rapidly security in particular job functions is impossible to maintain. Thus within the firm job security can only be achieved in practice if there is the opportunity for high mobility and rapid acquisition of new skills by existing employees. This is the human capital approach I referred to earlier which seems to be characteristic of the successful Japanese firms and the most progressive American firms.

. But there are many industries, typified by bulk steel, automobiles, shipbuilding, and petrochemicals, in which worldwide overcapacity is developing because of a combination of market saturation in developed countries with the desire for indigenous manufacturing in the developing countries. Because of higher wage levels in the developed countries, they can only retain their share of a slowly growing market by rapid improvement in productivity through technology and work reorganization. This implies an inevitable reduction in the number of jobs. The layoffs already experienced in these industries are likely to become permanent. Furthermore, the somewhat easier present situation in Japan seems likely to prove temporary. Any policy of job security is likely to be severely challenged in these industries worldwide, as we are already seeing. It is a challenge to political and other institutions to expedite mobility and retraining of people out of these industries into more rapidly growing ones, including those offering entirely new products or services. Clinging to traditional industries for purposes of maintaining employment is likely to be self-defeating in the long run. If employment is temporarily sustained by subsidies and protection, it will retard growth in other areas of the economy and make the ultimate adjustment problem more traumatic.

We are also seeing a worldwide trend toward disenchantment with bureaucratic organizations with highly fractionated job responsibilities and elaborate systems of hierarchical controls. It is interesting to observe that this trend is occurring simultaneously in capitalist and socialist countries. There appears to be much in the program of Solidarity in Poland that finds echoes in experimentation with self-management and industrial democracy in the major capitalist countries. The future of all this is not entirely clear. Bureaucracy, but also the more thoroughgoing types of worker democracy, appear to introduce rigidities into the economic system which lead to retarded growth and imperfect adjustment to technological change, including changes in international competitiveness induced by the rapid diffusion of new production technology in today's tightly interdependent world It seems clear that bureaucracy in both government and industry is on the defensive, if not on the skids, but what will replace it is not so clear. What seems to be required in the present situation is vigorous and diverse social and political experimentation, many examples of which have been described in these hearings.

It may also be true that the shift in emphasis in technological innovation will be from labor saving to capital and resource saving technologies. We are already seeing this in the field of energy, but it is apparent also in resources and capital. An example of the latter is the use of robots to reduce the idle time of expensive machines. An example of the former is the use of information technology to reduce energy consumption in buildings, transportation, and factories, including the substitution information transfer by telecommunications for travel and the use of data processing to manage inventories. In all of these areas "software" invention—where software is used in a very broad sense—may be more important than hardware.

Mr. LUNDINE. Thank you very much. I was very fascinated by your analysis of changes in office technology. In fact, one of the objectives of these hearings is not to cover the same ground that other committees have, but to try to explore some new dimensions in terms of work innovation and to anticipate some problems that probably haven't been written about or studied in as much detail.

While we will focus a little on manufacturing and some of the more traditional industries—as you know, we are particularly interested in the impact of technology and the need for innovation in work systems in the office and service and information industries.

It strikes me, though, that while the introduction of the new technologies into the office has the possibility of relieving drudgery, as you pointed out, it also has the possibility of introducing a new form of monotony. I am always fascinated, if I'm alone in my office at night, by that silly typewriter that is spewing forth letters for us to answer with no one there. [Laughter.] I feel as if 1984 has come early. Maybe that isn't perhaps a very sophisticated example of what I am talking about, but isn't it possible that a lot of the new office technology will result in even more boring jobs and more repetitive situations, not unlike—the testimony we had yesterday observing that the problems at Three Mile Island, for example, were human problems, and problems of boring work and undefined authority to deal with an emergency when it comes up.

My question is, first of all, isn't it possible that these new technologies may create even more boring work, which has a detrimental effect on output and job satisfaction, and secondly, what observations would you have for innovation that might avoid that kind of a consequence, if there is that possibility?

Mr. **Brooks**. Well, the answer to the first question is certainly "Yes." That is what I meant really when I said that the new office technology provides the first real opportunity for the "taylorization" of offices, and so it could go to what you're saying. I completely agree that it could go exactly in the wrong direction. It could go in the direction of further fragmentation of office jobs, increasing the routinization and boring nature of these jobs.

I think your second question is much harder to answer. The only observation I can make—I am not really expert in this area, and I know you're going to have a whole session on this next week. I think this is an area where what is referred to as sociotechnical design is absolutely essential. And by sociotechnical design I mean a design process in which the human factors are integrated into the design process, not as an afterthought, not after the technology has been developed and deployed, but in the very process of conception of the technology or the technological system.

I think one of the difficulties we are faced with in this area at the present time is that the institutions that are developing the technology are separate from the institutions, for the most part, where it is being applied; therefore, you have sort of an arm's-length seller-buyer relationship, where it becomes very difficult to do the sociotechnical adaptation process that I have been talking about.

In contrast, I think you can say that in some of the process industries, for example, the chemical process industries—where the designers and the final operators of the plant are in the same industry—it is possible to involve the operators in the design process at a very early stage. The human factors are generally much better handled in that kind of a situation than they have been in the office technology situation.

You referred to Three Mile Island, and I think that is another example of this arm's-length relationship between the ultimate operators of the plant and the sellers and producers of the technology which has created the same problem.

Mr. **Lundine**. Many times these things come down to pretty simple situations. The mayor of Seattle not long ago was telling me about a situation where he had lunch with average municipal workers on a regular basis. One fellow who had the most hostile attitude he had ever encountered worked in the parks department. It turned out that he had been mowing grass in the parks for 20 years, keeping the mowers together with baling wire, brought from home. They went out and purchased a new mower at an equipment show and gave the mower to the fellow who was the nicest salesman and invited him out to dinner, and it alienated this particular worker to the degree to where he wanted to break the equipment.

It seems to me that the same kind of human, small experience has a great susceptibility to happening in offices, where systems are plugged in. I suspect that might even happen at Harvard. I've heard it has happened at Columbia, anyway. The people involved in it are in a way required to fit the office technology after it is bought, rather than being involved in the selection.

Mr. **Brooks**. Exactly, yes.

Mr. LUNDINE. I don't want to take excessive time, but I would like to touch on one other major point you raised, and that is the whole job security question.

You have added a fascinating dimension to the contrasting information or misinformation we often get about Japan and the United States. But you are more gloomy than I about steel, automobiles, shipbuilding, and chemicals. While it may be true that there is a worldwide overcapacity, it seems to me that recent experience suggests that the combination of applying technology, which is probably available on a worldwide basis about the same to different countries, and integrating that with progressive work systems leads to a competitiveness even in the tough industries.

I agree with you, that Japan is probably going to run into the same types of problems as the United States in automobiles, but don't you think that we have no choice but to try to be much more productive in those areas because we can clearly see that the result of declining productivity costs jobs, just as much as any automation costs jobs.

Mr. BROOKS. Yes; I agree with you, and I think we have no choice, just as you say. But the point I was really trying to make was that improving productivity in industries with slowly growing markets will preserve some jobs, but it can only really happen at the cost of displacement of other jobs.

Now, hopefully you can take much of this displacement by attrition rather than by laying off people. But nevertheless, it seems to me that the combination of improving productivity which is necessary to retain any share of the market at all and a slower growing market means less jobs. Even if by improving productivity you retain the same share of the world market as you had in the past, that implies meeting the market demand with a smaller labor force, because productivity improvements means making the same amount of goods with fewer people. So I think just the arithmetic makes it inevitable that you're going to have declining employment in those industries.

Now, I would agree with the implication of what you said, that if you don't improve productivity, then you lose the market share and the decline will be even greater. But you are in kind of a "damned if you do, damned if you don't" situation. In other words, if you improve productivity enough to keep market share, you are also not going to save jobs. But you're going to probably save more jobs and save better jobs than if you don't do anything at all about declining productivity.

Mr. LUNDINE. I take it you would also agree that by making jobs more varied and more multiskilled, workers probably have a better opportunity to make the transition into other areas.

Yesterday we heard of a fascinating example in Norwegian shipping, for example, where they did reduce the number of workers on a ship and they improved their world competitiveness. But in their case they also did not reduce employment because they got a greater market share and were more competitive. Einar Thorsrud also pointed out these same people were getting such highly skilled work characteristics that they were much more employable in other industries if they got that employment.

Mr. **Brooks**. Also in these traditional industries, if you increase their competitiveness and increase their productivity, rather than trying to maintain employment with subsidies or protection, this provides the opportunity for greater growth in other parts of the economy because you are using less resources in that industry and, therefore, there are more job opportunities elsewhere in the economy.

Mr. **Lundine**. Right.

Just one other—so the point you're making is, we should try to have public policies that more accelerate that process rather than public policies, as we had in the past, that really try to retard it?

Mr. **Brooks**. Exactly, yes.

Mr. **Lundine**. Mr. Shamansky?

Mr. **Shamansky**. Thank you, Mr. Chairman.

I have been listening to this concern about increasing productivity, but it seems to me futile to increase productivity of products that aren't going to sell. And by that I mean, with respect to the marketing—it's not just a question of productivity. The American economy and the American manufacturers aren't designing the products that the public wants. To increase productivity for an item that isn't going to sell seems to me an exercise in futility.

I am looking for a portable, shortwave radio that can fit into a little handbag small enough to place under the seat of an airplane. The only one I can find is a Sony. The Americans have abdicated control in that field. The American automobile industry has abdicated competition for the small cars, even though previously our percentage of the market previously going up. This was even before 1973. They simply weren't going to bother with it.

Now, I have a fairly up-to-date General Motors car. It has the same windshield wiper that has been used for the last 40 years. I can't get a windshield wiper that has electric filaments in it so that the slush won't build up. I know the patents are this long at the Patent Office because I paid $300 to have it checked. I called an R. & D. Man in Rhode Island and I said, "Do you know about these?" He said, "Oh, yes, we know about them." I then asked why he wasn't building them. He responded, "We can't build them because GM never asked us to."

The point is they have had plan X for just such technology for the last 25 or 30 years. The technology of the windshield wiper in American cars is available, yet has not changed.

Now, my point is, we have got marvelous job security in the upper echelons in General Motors. Apparently, in this case, this job security is stultifying.

What does Harvard do about that? I mean, you're the end all and be all for me and you have to tell me this.

Mr. **Brooks**. I don't know, but your diagnosis is certainly correct. I think the factors behind it are complex. I think one of the things that happened in the U.S. automobile industry is that because we had so much cheaper fuel prices for so many years than the rest of the world, the U.S. automobile industry developed its own sort of closed market in the United States and was not very interested in the world market. And as long as fuel prices were so cheap, the American consumer was not interested in small cars.

Mr. SHAMANSKY. Professor Brooks, there was an editorial in the Washington Post recently about Volkswagen coming up with a car averaging 70 miles per gallon. The Battelle Memorial Institute, which is in my community, Columbus, says you can make one that will average 100 miles per gallon. But General Motors and our American companies are concentrating on the 20- to 40-mile-per-gallon range.

At what point does the "shake out" occur, or does it ever? I mean, I buy what you said for 1973, but this is 1981—it's 8 years later. Now what's the story?

Mr. BROOKS. Well, I think what I'm really saying is, the management habits that have developed over this period of the secure, oligopolistic market that existed before 1973 die very slowly, and I think——

Mr. SHAMANSKY. Before the company dies?

Mr. BROOKS. Well, I think that's the question. It's a race.

I do think that General Motors has changed in this period, but whether it is changing fast enough and whether, even more to the point, whether the other companies are changing fast enough, is another question.

Mr. SHAMANSKY. What indication do you have that they're changing at all? I mean, if Volkswagen comes out with 70 miles per gallon and we're struggling to get to 40.

Mr. BROOKS. It isn't clear, you know, that gas mileage is everything in a car——

Mr. SHAMANSKY. It recently has meant a lot, though.

Mr. BROOKS. Of course it has—yes—because of the price shocks that we have had. But I think there is no question that the American companies misjudged the market.

Mr. SHAMANSKY. Well, if I may—just one other thing: In the consumer products industry especially where appetites can be insatiable if you come up with a good idea, where is the innovation? For example, use the Japanese ability to design cameras that do the things the Japanese want, through analyzing a market and designing a product to hit that market. Do you have any views on that?

In other words, it seems to me that the costs of labor, which I am assuming are in somewhat highly automated manufacturing processes, is decreasing, so the real factor in selling a product is not labor but design.

Mr. BROOKS. Absolutely.

Mr. SHAMANSKY. Why can we not compete in the design factor?

Mr. BROOKS. I really don't know the answer to that.

Mr. SHAMANSKY. Are those questions being asked at your institution? Are they being asked at the General Motors, the General Electrics, and so on?

Mr. BROOKS. I think they are.

Mr. SHAMANSKY. What kind of answers are they coming up with?

Mr. BROOKS. Well, one can speculate about a lot of different answers. I guess one of the questions is whether, in fact, the management traditions that have grown up in the United States in the last 20 years are really appropriate to the situations that we face in the future. There is a big debate going on, in fact, within the Harvard Business School now, and some people on the faculty of the Harvard Business School are, in fact, attacking the philosophy of the school with respect to management——

Mr. SHAMANSKY. Which is what? How would you characterize that?

Mr. BROOKS. It places too much emphasis on short-term profitability, a very formal return on investment analysis, and quantitative criteria, for investment that sometimes ignores the imaginative intangibles which are involved in the kinds of consumer products that you were just talking about.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

Mr. LUNDINE. Thank you.

I might add that we have one slot left in these hearings, presumably to be filled by American business. In hearing the gentleman from Ohio, I will redouble my efforts to get a representative of General Motors so that Mr. Brooks doesn't have to— –

Mr. BROOKS. I sold my General Motors stock a long time ago, for the reasons that you said. [Laughter.]

Mr. LUNDINE. Mrs. Schneider.

Mrs. SCHNEIDER. I don't know if I have any answers, but I would like to present a couple of theories. I think perhaps some of the people at Harvard Business School are raising questions and attacking the way management procedures have been taught, perhaps because they have been looking closely at the leaders of productivity in the world. With close scrutiny, it is quite simple to understand that their modus operandi is quite different than our own.

I think that leads back to addressing Congressman Shamansky's question, as to why aren't we proceeding further and faster in doing better what we're doing. Part of it relates to general philosophy and management principles, and I think another tangible is that insofar as business and industry investment in their own and new product research are concerned, by comparison, the Japanese spend much more on research within their own companies, than we do.

I am very fortunate to have gone to Japan and to have had the opportunity to visit Mitsubishi and a couple of other firms and to find out what they are doing. I also had the opportunity to talk with the American Chamber of Commerce that is located in Japan. Each of those individuals that were represented there—about six American businessmen—all had basically the same thing to say, and that is, "It looks like we have got to start changing our philosophy in order to zoom ahead and increase our productivity."

The essense of that philosophy is based on two concepts: An integrated working relationship between labor and management, and, rather than looking for the overnight returns on investment, long-range planning, where industry has intentions of getting the best available technology within the shortest amount of time, and continually moving on ahead.

I think that, unfortunately, we have a tendency to develop a product and not see where we're going beyond that. But, it seems to me, that, having had the benefit of having taken some courses at the Kennedy School, it would be great if you had the opportunity to meet with the corporate heads and we could really start a national symposium or movement toward analyzing exactly what it is that drives our country and what it is that we are lacking, so that we can move forward.

I know that many of us who sit on this committee are frustrated when we see the budget being cut. We know that the Government's role in research and development is being minimized. Now, if Japanese businesses can invest in R. & D., then why can't our own businesses invest in R. & D. and not look for the government to push it along?

The usual procedure is to have witnesses come to testify and ask for help from Members of Congress. I think that all of us here today hope you will go back and encourage the corporations and the Harvard Business School to become more involved in bringing this discussion to national attention. From our part we will be most enthusiastic to support you in that effort.

Mr. BROOKS. As you know, Harvard cosponsored with one of the Senate committees last spring a conference on exactly this subject, which I guess the proceedings are about to be published.

Mr. LUNDINE. Mr. Brown, do you have any questions?

Mr. BROWN. Dr. Brooks, I appreciate your being here this morning. As always, you make a useful contribution to the proceedings of the committee.

I don't know whether earlier questions covered this, but you raised a couple of extremely important points in your statement about which I wanted to ask. In discussing the new information technologies, you raised the question about whether the market could produce the most socially desirable uses of these technologies. Later on you discussed the growing disenchantment with bureaucratic modes of organization.

Both of these suggest a third area, and that is, the need to be concerned with the end purposes of the activity. If the market is not producing the most socially desirable uses of a technology, and a bureaucracy the most productive uses of human beings, there must be an underlying goal we are seeking to achieve here. Obviously, at first blush it appears that we're trying, to quote a phrase, to encourage the human use of human beings to establish social goals in a collective way. Neither of these are very popular in our current society.

Does the program at Harvard address this broader problem? In other words, do you have a philosophical component; do you seek to encourage a broader vision of what we're here for?

Mr. BROOKS. Yes, we try to. Another way of stating the point you made, I think, is that productivity, which is an innovation which is very popular today, cannot be an end in itself—productivity for what, and innovation for what? I think this raises some very, very difficult problems. We do have a lot of discussion of this. I can't say—it would be difficult to summarize in a short——

Mr. BROWN. Have you looked into the work of the early anarchists who went through the same discussion and came to the conclusion that an anarchical arrangement of society was more productive than other forms of organization?

Mr. BROOKS. No; I don't think we have done that particular analysis.

Mr. BROWN. Well, we had better not follow up on that point, then. [Laughter.]

I have no further questions.

Mr. **Lundine**. Mr. Brooks, thank you very much. You have made a real contribution I think in setting a tone for these hearings, and we appreciate it very much.

Mr. **Brooks**. Thank you very much, Mr. Chairman.

Mr. **Lundine**. The next witness is Richard Balzer, vice president of Yankelovich, Skelly & White. He is responsible for working with the SIGNAL program, various international projects on job opportunities in the eighties, and the quality of working life. He is the former director of the American Center for the Quality of Work Life, and before that worked for the Massachusetts Bay Transportation Authority.

I don't usually go into people's background this much. I want to do this for the reason of making a point. He's a graduate of the Yale Law School. However——

Mr. **Shamansky**. We'll forgive him that. [Laughter.]

Mr. **Lundine**. Then he went on from there to Cornell's Industrial and Labor Relations School, and has since found ways to make an honest living in the world of work. [Laughter.] He is the author of four books, the most recent entitled "Clock-work: Life In and Outside an American Factory."

I would like to welcome you very much here, and I would like to say I think it is particularly appropriate that we have an analyst of America's attitude, because my own experience is that attitudes can affect productivity and innovation just as much as technology, just as much as investment and other factors. We look forward to your analysis. Welcome.

[The biographical sketch of Mr. Balzer follows:]

Richard Balzer

Mr. Balzer is currently a Vice President of Yankelovich, Skelly and White, Inc. He is responsible for working with the SIGNAL program, various international projects on job opportunities in the 1980's, and the quality of work life. He is the former director of the American Center for the Quality of Work Life, and previous to that, was first assistant general counsel to the Massachusetts Bay Transportation Authority.

Mr. Balzer is a graduate of the Yale Law School, and Cornell's Industrial and Labor Relations School. Mr. Balzer spent eighteen months in Europe as a fellow of The Institute for Current World Affairs writing about industrial democracy. He is the author of four books, the most recent entitled "Clockwork: Life In and Outside an American Factory."

STATEMENT OF RICHARD BALZER, VICE PRESIDENT, YANKELOVICH, SKELLY & WHITE, INC.

Mr. **Balzer**. Thank you, Mr. Chairman.

Having submitted some written comments, and having heard Professor Brooks speak and having heard the questions, if you don't mind, I will cover some of the points in my statement in a less formal manner.

Mr. **Lundine**. Your statement will be made a part of the record, without objection, and you may proceed as you wish.

Mr. **Balzer**. Fine. I hope during the questioning period Mr. Brown will give me a chance to discuss Paul Goodman and Saul Alinsky and some late social anarchists' views on this subject.

And to Mr. Shamansky, I would hope that we would get a chance to talk further about this notion of short-term profits and how the kind of management ethos that is based on that has helped and hurt us.

And, one last point to the chairman, hope to talk about a move that I think is going to occur in this country, which is a movement away from job security and a greater move toward employment security, which will offer both more security to the worker and a greater flexibility to the employer.

Now to my comments. I would like to talk about five things this morning. One is the changing nature of work; the second is the changing demographics of the work force; the third is some of the changing work values which obviously are at the heart of the work that we do at Yankelovich, Skelly & White. Fourth is why organizations and the country should be concerned about changing values and attitudes; and fifth are some of the implications.

In making my comments this morning, I would like to try to get to questions of both productivity and innovation and the human factor. Having worked on the factory floor at a Western Electric plant, and having served in the law department at the Mass Bay Transport Authority has given me a view of the bureaucracy in the private sector and the bureaucracy in the public sector.

Now, as to the changing nature of work, because I think that is very important to the work that you're doing, one of America's great successes and, in fact, even today in comparison to Japan, has been the agricultural revolution. The agricultural sector of this society is the most productive sector of the entire economy, and it is heralded around the world as the most productive sector of almost any economy in the world.

An interesting fact is if you look at Japan, and look at Japan's agricultural productivity, it pales in comparison to the industrial sector. Unfortunately, if you look at the productivity of our industrial sector compared to the progress in the agricultural sector, it has not proceeded as well as the agricultural sector.

However, we are in the midst of a new revolution, if you will, away from workers being in the industrial sector and more workers being in the service or information sector. As you may well know, in 1950, 65 percent of the work force was in the industrial sector, and today that figure is 30 percent. In 1950, 17 percent of the workers were in the information area, and now that number is 55 percent. That is a staggering change and all the information and projections we have suggest that there will be fewer and fewer workers in the industrial sector.

The real question is not the number of people in the industrial sector, of course. The real question is how productive it is. That is less a question of numbers than what is produced, how we produce it, and how we use the technology available.

The second area I would like to talk about is the changing demographics of the work force. One figure that I often use when I talk to groups is, that in 1955, 70 percent of the American work force was made up of a male, head of household, the only working member in that family, with a wife and one or more children in the house. In 1981, that person represents less than 17 percent of the work force.

I would suggest that that is a startling change, and part of the problems that we have in today's organizations are that the rewards and motivators set up to work for that person who was once the majority of the work force are no longer viable for a work force that has changed. Our family structures have changed; the so-called nuclear family, once the heart of America, is no longer a majority. Fewer than one-fifth of the population are in nuclear families. There are more divorces in this country, more people without children, more people not getting married. We have more dual-wage-earner families. And every projection that I have seen from 1950 on, projecting the number of women who would enter the work force, has seriously underestimated the number of women who would seek careers in the paid work force. Those are the kinds of changes that we are seeing.

Now, at the heart of the work we do at Yankelovich, Skelly & White are work values. I would like to start by giving you a couple of anecdotes which show how the popular media and press pick up some of the new values. Some of you may be familiar with some of the Schaefer advertising that goes on on television. One of the ads shows a bunch of young fellows at a ski lodge, and one of them comes out and says, "My God, it's snowing. We won't be able to get home and I won't be able to go to work tomorrow." He stares out with a long face, until a couple of his friends come out, throw their arms around him, and say "If we can't go, we can ski all day tomorrow. We're in Schaefer City."

Now, that suggests a certain value in skiing as opposed to a value in work, an image that would not have occurred, I don't think, on a television screen 10 to 15 years ago.

Being interested in literature as well, I would like to share with you one of my favorite passages from a book called "Even Cowgirls get the Blues" by an author named Tom Robbins. The protagonist in the book one day calls up his employer and says "I'm feeling well today, so I am not coming to work." He suggests that everybody call up occasionally and tell their boss "I'm feeling well today, so I am not coming to work." Again, it's a very interesting image about work.

Now a little more serious thing before I get to values. I would like to talk to you about one of the most interesting things that happened to me when I worked at a Western Electric plant in North Andover. A woman that I worked with told me a story that she had been employed as a bench hand at Western Electric for 25 years. After about 16 years, one day she came in very late, and her supervisor had asked her why she came in late. She said, "My son was sick today and I had to tend to him." He said to her, "You have a job, and you have to come in. That is more important." She said she was only a couple of hours late. He said, 'You're going to be docked for the time you were late."

That woman said from then forth, if her son was ever sick again, she would take a sick day. What that man had done was make a liar out of her.

Now, I don't think it goes too far to say that any person who could testify in front of this committee, and in fact any of you talking about your own work experience, or experience with Government, can talk about how people are undervalued, underestimated, and the importance that people place in feeling important and how all too frequently organizations in this society make people feel unimportant. That, of course, gets to the value changes that have occurred in this society.

We at Yankelovich, Skelly & White suggest, given a segmentation that we have done of the work force based on 3,500 interviews, that approximately 50 percent of the work force under 35 years of age who have traditional work values and 50 percent who have what we phrase new work values. Those new work values tend to fall out in two areas: One is a group of workers whom I think you would be critically interested in whom we call fulfillment seekers, who are particularly interested in finding greater fulfillment at the workplace.

We have another group which we call money seekers, who are people who are interested in expressing who they are outside of work. Work is a way for them to get enough money so they can go sky diving, or any other activity outside of work. I think the interesting thing that we have to suggest is what has occurred in this society is that the work force has become more and more heterogenous, and that most organizations tend to deny the heterogeneity. It is interesting as a society we have accepted heterogeneity of lifestyles, but at the workplace we haven't, and in the workplace we're using old motivators to continue to do work that they can no longer do.

One interesting thing in this regard is, if one looks at President Reagan's family, now the President who represents this country, here is a man who has been elected to the highest office in the country, who is divorced, he has children who are divorced, children who have been married several times, children whose activities have been much made of in the public press, and yet in some ways this is the typical American family. All this is to suggest that we have accepted a kind of diversity of lifestyles outside of work and not inside of work.

The seeds of this change, of course, are the seeds of our own success. Mr. Shamansky talked about our need to continue our success, but part of our problem is that America economically was terribly successful from the period of approximately 1948 to the early seventies. Much of our younger work force grew up, therefore, in a period of great affluence, a period of a great belief that the affluence of the country would never be diminished and there would be continuing prosperity. These helped produce some of the new values.

Some of the old values of self-denial, of saving for tomorrow, as everyone can see, has given way to an increased focus on self. How am I doing, what is important to me, an immediate need for gratification.

Why do organizations need to concern themselves with this? I think if things weren't bad in this country, in the sense of our own economic prosperity, you could argue that organizations need not worry. However, whether it is competitiveness or the quality of the products that we produce, we are, in fact, in difficulty.

Again, I give two examples of the kinds of things that have happened in the blue collar work force and the white collar work force.

The first is, one of the ways we used to punish people who didn't come to work regularly was to tell them that they would be suspended for a day without pay. Now, I have spent a lot of time talking to managers, and usually when I ask a manager how much power does he think there will be in having somebody having a day off from work because they haven't come in, and they say "not much." And when you interview people and ask them why they only come to work 4 days a week instead of 5, they often say it's because they can't earn enough money in 3 days.

On the other hand, if we look at white collar workers, it used to be in this society that for your career, if your employer asked you to move to one city or another State to advance your career, you accepted that as part of the right that an organization had to look after your career. More and more organizations are finding that people will not move. More and more organizations are finding that when they need that little extra that people are not able to do that.

That is why organizations need to be concerned, in fact, about the human factor. The organizational implications, I would just like to spend 2 minutes to suggest one of the interesting differences, and differences I think that point up differences between innovation and productivity.

Many people will be talking here in the next few days about all sorts of sociotechnical systems, all sorts of programs, whether it be quality of work life or QC circles. Many of them are aimed at giving greater autonomy and flexibility to blue collar workers, allowing people to participate more and more, which seems to be a concern according to our data of the vast majority of the work force in America. These are all well and good and we think will help, on the productivity equation.

Interestingly enough, the issue of innovation is a different notion. In the fifties companies like GE and Bell Labs and other companies were doing many of the things that we are now talking about doing for blue collar workers. The problem is now, if we are looking at the kinds of people who will help spur innovation, there are competing things that they can spend their time with; they can spend their time devoted to work, or they can spend their time devoted to things outside of work. We will have to figure out organizational structures and reward systems that make the kind of work that is done exciting enough that people bring their minds and attention to it. Again, this is a kind of change.

In the 1900's, when you could measure the number of widgets that a person put out in an hour, you at least had some measure of productivity. When you're talking about a knowledge worker, and a person who can close the door at work, it is very difficult to know whether that person brings 20 percent of their brain or 90 percent of their brain to work that day. But as an organization, it is, in fact, a great concern.

In ending, I would like to go back—because it is often best to go forward by going back—to go back to the Hawthorne studies that took place in this country in the 1930's, when Elton Mayo looked at one of the Western Electric plants outside of Chicago. They wanted to see what kinds of things have an impact on productivity.

First they tried the lighting. They turned the lighting up and people produced more. Then they changed the way things were to be processed, and productivity went up. Then, just out of curiosity, what they did next was they started turning the lights down, and people produced more. They went back to harder time schedules, and people produced more. In the last 30 years we have neglected the real impact of the Hawthorne studies. What was said was, since there was no direct cause-and-effect relationship, this scientific experiment had to be discarded. Of course, the real learning from the Hawthorne studies was, if you pay attention to people, and if you give them some sense of ownership in the process that they are part of, they are likely to be more productive.

Thank you very much.

[The prepared statement of Mr. Balzer follows:]

STATEMENT OF RICHARD BALZER

The question of the human factor in regard to productivity is not new. As most of you may recall, the famous Hawthorne studies conducted by Elton Mayo in a Western Electric plant in the 1930's were really about the human factor and the productivity equation. However, over the years the human factor as a part of the productivity equation has always seemed to play a secondary role. We, at Yankelovich, Skelly, & White, feel that increasing attention will be paid to the human factor. The main reasons are economic. America has always been a very practical country. One of America's business adages has always been, 'if something isn't broken, don't fix it.' From the end of World War II up until the 70's it was hard to argue with America's business success, but objective economic conditions in this society have changed. Productivity increases have, as all of you know, declined. The rate of innovation, a major factor in America's economic success, has also declined. As these things have occurred, greater attention has been drawn to the human factor and its contribution to the productivity equation.

My firm, which for the past 10 years has been tracking social change in America has found increasing interest among its clients in understanding the values and attitudes of the workforce, and the organizational implications that these values and attitudes portend. This morning I would like to talk about these values and attitudes in the context of five topics:

First, the changing nature of work; secondly, the changing demographics of the workforce; third, and central to my talk the changing values and attitudes of the workforce; fourth, and critically why organizations should pay attention to these changes; and fifth, very briefly, some of the organizational implications, both in terms of productivity and innovations, of the changes that have occurred.

The nature of work in America in the last thirty years has changed dramatically, and all indications are that change will continue. We are probably in the midst of a work revolution that will equal the great change that moved us from a primarily agricultural society to a primarily production based society. In the early 1900's a majority of people in this country were involved in work on farms. Over the last sixty years each decade saw fewer and fewer people involved in agriculture and yet a greater and greater productivity in the agriculture sector. A somewhat similar change is occurring in the industrial sector. Fewer and fewer people are actively engaged in the industrial sector of our society and they are producing more and more goods. There is still an open question as to how successfully this change will be and whether or not we can match the productivity gains realized in the agricultural sector in the industrial sector. Whether we can or not the movement of people away from the industrial sector continues. The magnitude of change is best illustrated by the fact that in 1950 65% of the workforce in this country was involved in the industrial sector. Now, 30% of the workforce or less than half of that number is engaged in the industrial sector. Similarly, in 1950 17% of workers were involved in the information area. Now 55% of the workforce is involved in the purveyance of information.

More and more working with one's head is replacing working with one's hands. We are more and more becoming a society where knowledge work and knowledge workers are going to be the dominant feature of the economy. In the decade ahead, we will more and more be dependent not on people working harder but on people working smarter, as well as the increased utilization of robots, automation and technology to help increase the productivity of the industrial sector. I would like to suggest in this regard that we have, and certainly this will be discussed by others testifying in front of this committee, some very interesting things happening with new technology. On one hand, the new technology such as new communications systems will allow some people more freedom and autonomy. It will allow some people to no longer work in an office setting but to work at home. On the other hand, the same technology will allow for greater control of people. For example, the new word processing equipment has the capacity for greater specificity of measurement of productivity in terms of output. Whereas a secretary's work has heretofore been hard to measure quantitatively, with a word processor there is a capability of measuring how many letters are struck. Not only that but when one job is completed the word processor has the capability of immediately presenting the next job. One of the critical questions for the coming decade will be how technology is employed.

Secondly, I'd like to talk about the changing demographics of the workforce. Often we do not fully consider these changes when we look at work. The composition of the workforce,as we think of it,has changed markedly. Probably no one set of figures captures the magnitude of this change better than the following: in 1955 70% of the workforce was made up of a male, head of the household only working person in the family wife at home and one or more children. Today, that person represents, remarkably enough, less than 17% of the workforce. Today there are more dual wage earner families; there are more single people working; there are more divorces and more than anything else there are more women working.

Another dramatic change has been in the age of the workforce. The workforce in the last 20 years has gotten younger and younger. Sometimes we are asked by employers or administrators or union officials why should they concern themselves about the younger, so called new breed worker. And our response is if they were only 10% of the workforce maybe they wouldn't need to be concerned about them. But, when one realizes that out of 100 million people now working 50 million of them, or half of them, are under 35 years of age. This is a number that cannot be ignored and the values and attitudes of these younger workers are therefore very important.

In addition to these changes the workforce is more educated. People may disagree about how educated the workforce actually is and about the quality of education that people receive. But one thing is irrefutable and that is the levels of education received keep rising. In a twenty year period between 1959 and 1979 the number of workers with fewer than 8 years of school has declined by 56% while the number with one or more years of graduate education rose by over 200%. What you have then is people often filling jobs that before required less than a high school education now with not only a high school education but some college experience as well. These people have come out of school with higher expectations of what they can expect from a job and what they're entitled to. When organizations and institutions are unable to meet these expectations there is a greater probability of higher levels of frustration.

Organizations, by in large, have been slow to fully grasp these changes in the workforce. Rewards which worked well in the 50's, when the workforce was dominated by a male sole breadwinner, are not as well suited for today's more heterogenous workforce. Organizations are now readjusting structures, rewards, and motivators in an effort to better capture the talents and skills of the workforce.

Third, and most important to the work we do at Yankelovich, Skelly and White is the values and attitudes of the workforce. For twenty-five years we have been tracking social change in America. During the last ten years we have been identifying, and trending social change. Three years ago, we initiated a service called SIGNAL which specifically looks at the changes, attitudes and values of the workforce. At the time we were convinced that the human factor would increasingly be seen as an important component in the productivity equation, and felt we could be of assistance to organizations by looking to employees themselves. SIGNAL is a research based information service which annually surveys 3500 people.

Our research has led us to a segmentation of the workforce that differentiates between workers having traditional values, and what Dan Yankelovich has termed the new values. Our data indicates that nearly 40% of the total workforce has new values and for workers under 35 years half have new values. New values workers can be characterized as having an increased focus-on-self, a stepped up sense of time, need for instant gratification, a desire to enjoy the full rich life, and need for fulfillment at work.

It is important to understand the roots of these new values. They did not appear miraculously, but have evolved over the last thirty-five years. People emerged from the end of World War II with a great hunger for economically bettering themselves and improving their conditions. There was a tremendous optimism and a thirst for material possessions. The American dream, at that time, was owning your own home, having your own car, a place in the suburbs and keeping up with the Joneses. The economy prospered and real wages grew impressively. The success of the economy was partly a product of the existence of what has been termed the protestant work ethic. Work and doing a good job was important to people. The period of the late forties to mid sixties was marked by conformity, the belief in self-denial, and sense of the importance of putting off pleasures of today by saving for tomorrow.

As we all know things began changing in the sixties. Youths of the sixties, unlike their parents, grew up with a psychology of affluence and a belief that the society would always prosper. The sixties were a period of social upheaval. The student movement, the civil rights movement, and the women's movement all questioned the American dream, its worth and the ability of all groups to share in it.

By the beginning of the 1970's there was an erosion of the notion of self-denial and replaced for many by an increased focus-on-self. Conformity was being overtaken by individualism, and savings, an indicator of a future orientation, dropped marking an increased desire for instant gratification. Over time we have accepted many of these changes. In fact, as a society, we are much more accepting of a diversity of livestyles and leisure interests than we were thirty years ago. However when it comes to work we have had a harder time as a society adjusting to new values and attitudes. The replacement of the importance of work for its own sake by a sense that a person wants more than a job, seeks growth and fulfillment at work rather than a job has been difficult for organizations. The diversity and individualism accepted outside of work is still not accepted inside work. There is still an effort to homoginize an increasingly heterogenous workforce. If as a society we are to continue to grow and prosper we will have to devote increased attention to the very real differences that exist among various segments of the workforce.

The fourth question I posed originally is why organizations should be concerned about the human factor. Some might suggest it is because it is right and important. Maybe, however, the explanation for increased concern with the human factor is probably far simpler. The American economy of the 1980's is not what it was in the 50's or 60's. America's economic dominance in the world economy has been eroded. First there was the competition of the Europeans, and now the highly successful Japanese with their different ways of managing workers have caused us to seriously question the way organizations are run. A growing concern about competitiveness, lagging innovations, and the quality of good produced are all strong arguments of why organizations need to pay greater attention to the human factor.

If such reasons are not immediate enough organizations must be concerned about the values of new workers because they seriously call into questions many traditional motivators, both rewards and punishments. Let me give you a couple of examples of old motivators that seem less potent: If someone used to be absent too many times the way that person would often be punished would be to say if they didn't come to work they'd be laid off for a day. It's hard to meet a manager that now believes that is an effective way to deal with that problem. Lest it be thought that the winds of change have only affected blue collar workers, let us look to the ranks of management to see an equally important change. Fifteen years ago, few would question the right of an organization to ask a manager to move wherever they saw fit to help his career. Increasingly, organizations are finding increased difficulty when they ask someone to move.

And now, lastly some implications of these changes. One of the most interesting findings of our work is that a strong majority of workers cutting across all value segments are interested in greater participation. American workers seem overwhelmingly interested in having some say about the decisions that immediately impact on their work. We feel that whether under the name of quality of work life, quality circles, or other forms of consultation organizations will increasingly seek ways to tap into skills and talents of the workforce by involving them more and more in decisions that affect them.

A second key issue is the question of feedback. Our research shows that younger workers have an increased need for feedback. Often, current appraisal systems call for only annual or semi-annual appraisals. Our data suggests, and experiences confirm, that such appraisal is much too infrequent for today's new values worker. To older workers this need for constant feedback may seem unreasonable and excessive, but younger workers want it, and not getting it will affect their work. They have an intense need, like the current mayor of New York City to know "how am I doing?".

In conclusion the 1980's is going to be a remarkable period in which there will of necessity be a growing appreciation of the importance of the human factor to the nation's economic vitality. Organizations will need to better understand the values and attitudes of workers and then seek ways to operationalize that understanding. We would warn that an understanding of work values is important, but without an appreciation of how organizations adapt to and avoid change well intentioned responses to the human factor may be related to a kind of faddism that has plauged many organizational efforts in the last twenty years. Over the years an intense desire to reach for solutions before issues have been understood and the difficulties of change appreciated have left organizations with a succession of anacronistically labled programs that have a short life span. Currently the problem of faddism may be the fate of many quality circle efforts. There has been, of late, a rush to embrace Japanese quality circle. We would not suggest that quality circles do not have a place in American industry. Certainly as our research indicates, given the importance of participation to most workers, quality circles indeed appear an exciting way to involve workers with work related problems. However, unless an organization works on providing appropriate support structures and in other parts of the organization quality circles may suffer, as have many other good programs, a short life and never meet their full potential.

Our firm will continue to try to help organizations to find ways to better understand the values and attitudes of the workforce to allow for a greater fit between the organization's needs and the individual's needs.

Mr. **Lundine**. Thank you very much.

If the quality of someone's testimony is to be measured by the number of questions that I want to ask, yours is a very high quality.

First of all, yesterday we heard about a chamber of commerce study, I think it was, that suggested that 80 percent of American workers surveyed thought they could improve the productivity of their own jobs, but had never been asked. Do you and your surveys confirm that that is an accurate interpretation?

Mr. **Balzer**. Yes, it's a very interesting—though it was done, of course, by a competing organization, I think it is a good study. I would say that information is valid. Our own information would suggest that, in fact, there is a big resource in people not being asked, again because I think practical experience is always helpful in this regard. I can always remember another woman that I worked with—most of the people I worked in the plant with were women. An engineer would come down with a model, or what is called a sample, and he would say "Here is a new thing we have designed; could you put it together." And for a day or two she would say she wasn't very smart, she didn't have much of an education, but she would try her best. Then she would put it aside and then she would do it exactly how he did it.

I watched, and there was a younger person who not only would come down, he would say, "Look, we are having some trouble. I would like you to look over the plans that we're doing. What we are doing and how we're doing it." Also he would always ask about her family and her life, and she would always say, in a rather maternal way to him, "You have a mistake here; we can't build this this way." It is not only that people aren't asked and have a lot to say, but, in fact, people are not connected in a human way with the kinds of processes they do.

Mr. **Lundine**. Have you done any surveys of management attitudes to complement your studies of workers' values? In other words, why isn't management being asked and what are the implications of your comments that companies are going to make real adjustments, and I wonder how far they are already progressing.

Mr. **Balzer**. Well, I would take a less disparing view than some of the questions suggested about American management. I think there are a lot of mistakes in American management, but I think there are a number of companies that are at least making the attempts to change things.

I think change is difficult. I think a lot of the problems lie in middle management. There are continuing efforts by top management to get in the "know" with things and trying to get new processes and begin them at the lower level. But most people and organizations—and I would hasten to add this has also been my experience with long timer civil servants—know that the leadership of any organization is likely to change, and when that leadership changes, so will the ideas. Therefore, the best way to continue to be of service is to do as little as you can to rock the boat and just wait for the new administration or the new CEO to come in. It is a real problem.

So, one, I think it is the great difficulty in changing any organization. Two, our data—we also interview managers—suggests that managers increasingly see a problem, a problem of not getting enough information, a problem of not getting enough information down to the work force or concern about what they're doing. So I would say we are at a level where there is a growing concern. If anything, I would say the last 5 years have been mostly about sensitization. And now I see a great need to make what is sensitized operational.

Mr. LUNDINE. Well, you certainly confirm my own experience, that the people that are the most threatened by innovation in work systems are people in first-level supervision positions, because for the first time their decision on something can be challenged. You certainly, I think, give us an interesting perspective, that if we're going to change American management attitudes, we can't just go to the Harvard Business School and expect that that's going to solve the entire problem.

Mr. BALZER. If we do, we'll be in a lot of trouble, I'm afraid. [Laughter.]

Mr. LUNDINE. I didn't just make that comment because you graduated from the Yale Law School, either.

Mr. BALZER. I would have made the same comment about the Yale Law School.

Mr. LUNDINE. The other area that I would like to ask you about is, your testimony that 40 percent of American workers have new work values. As I recall, you said roughly half of them are fulfillment seekers and half of them are money seekers, and that business perhaps is not recognizing the heterogeneity of the workers' attitudes.

But how can business do that? I always can relate to manufacturing more. Outside of my home town, Cummins Engine Co. has taken a million square foot factory, which produces truck engines, and instead of having a straight assembly line where everybody does one thing, they have got the most exciting factory I have ever seen—and I don't usually get turned on by factory tours. But their whole production process is sort of in a circle, and people are working in teams. Engineers are truly consultants, who are called when the work team needs them, and the work team even is paid according to the amount of skills that they have. They even have something to say about who joins and who is fired from their work teams and that kind of thing.

But the point is, some people like that kind of responsibility——

Mr. BALZER. And some don't.

Mr. LUNDINE [continuing]. And some don't, particularly older workers who were used to the more traditional kind of manufacturing process. At Cummins, we're finding enormous stress as a result of this what I consider to be a very exciting work innovation.

But management has to have a system. They have to produce truck engines in some kind of a system. It is easy for you as an analyst to say " Well, workers have different attitudes," but isn't it hard for a business, that has to have some kind of a system, to accommodate to these differing attitudes?

Mr. BALZER. Yes.

I think Professor Brooks tried to begin at that answer, which is I think all you can ask for systems is that you plan them with the greatest amount of flexibility.

One of the frightening things, if I can attack this from another side, just as much of a problem it is to believe that everybody in the workforce doesn't care about work, it is an equal problem to sing the song that everybody wants to participate. Our data suggests there are significant numbers of people who don't want to be more involved in their job, and that if you ask a workplace to make up for what socialization or what people care about, you're asking the organization to take on too much.

I would quickly point out two things about—because it's a new fad in America—about Japanese quality circles, which trouble me. One, one of the successful reasons for Japanese quality circles has to do with the cultural view of the supervisor. A colleague of ours asked people in a recent polling in 1980 the following question: "If you got on a bus and your supervisor was there, would you (a) get up and give him your seat, (b) hold his bag, (c) nod hello, and [d] say nothing." The majority of the Japanese workers said they would either give the supervisor their seat or hold his bag. I would simply say to you that it would be an inappropriate question, in my experience, to ask an American group that question. If we did, we would have to phrase it quite differently.

The second part is, part of what you're looking for in a system not only is flexibility but beginning to build structures that allow for differences. One of the advantages that a place like Cummins has when it opens a new Greenfield operation is in part of its intake interviews it can kind of profile the kinds of people who would find, in fact, the kind of autonomous work group and teamwork a kind of exciting proposition.

The problem that I look at—because a lot of the organizations we work with don't have that opportunity. They have an existing workforce. So all we suggest to them is that you have to move from as much standardization and flexibility as possible—and I give you two immediate examples.

One, of course, is the issue of flextime. We found in our research that people are very much concerned with time, but the time they are concerned with is not having that extra day off, the 13th day off as opposed to the 12th day off, but some sense of control over time.

Now, a kind of flextime approach—I'm not saying it is appropriate for everyone—gives some people more flexibility. Similarly, although it is not yet here, I think in the next 10 years we will see more and more the notion of cafeteria benefits, and what that means is some people having some choice in the kinds of benefits. The easiest reason to see why this is important, of course, is if I'm working in one place and one of the benefits my organization says that I get is complete medical coverage, and my wife works down the street for another organization, and one of the benefits she gets is complete medical coverage for the family, one of us is not getting any benefits.

So I guess, Mr. Chairman, my answer would be even systems have to have a kind of internal flexibility, and one of the difficulties that differentiates between America and Japan is we are a far more heterogeneous society and the ways that we are going to have to appeal to people are going to have to be as individuals and less in a group sense.

Mr. LUNDINE. I hesitate to take too much time, but I also would like to point out that in existing workplaces where we have also had some experience in my home town, with strict union rules, you often have just as much resistance to the kind of flexibility you're advocating by the traditional union, as you do by the management, sometimes even more so.

You made a very good point, both in your testimony and in your answer to that last question, about rewards. Rewards also have to have a degree of flexibility. But here, too, it seems to me that union attitudes have not kept pace with worker attitudes. In other words, there still seems to be the tendency to buy out.

Do you agree with that?

Mr. BALZER. Yes, I would agree with that. I would say there is a difference. The hurting that industries are feeling and organizations are feeling is very immediate. We also from our data and from our experience would say that union leadership has to come to a different understanding about what its membership wants. Again, I think that litany that suggests how fewer and fewer people in this society are in unions would only suggest that unions are going to have to do the same thing other organizations are, and they're going to have to market themselves and understand what they have.

Having worked with Michael Maccoby on the CWA project, I would only suggest again that the experience is that unfortunately our labor relations often gets to arguing about bread and butter issues, and that increasingly workers come to the workplace assuming, as an entitlement, those kinds of bread and butter issues and have a number of other issues that they're concerned with that nobody is addressing, neither the organization they work for or the union that they may be represented by.

Mr. LUNDINE. Mr. Brown?

Mr. BROWN. The point that I was alluding to briefly in discussing with Dr. Brooks is sort of an analysis of comparative systems. As I am sure you recall, the first big division in the communist system was over the degree of centralization versus decentralization which occurred. In that fight the anarchists under Bakunin lost to those who supported the highly centralized systems. Goodman and Alinsky, I guess, have at least some heritage from Bakunin——

Mr. BALZER. Right.

Mr. BROWN [continuing]. Particularly Goodman who can be regarded as one of the great thinkers of our time.

Since you sought an opportunity to comment on that, perhaps you could say something about how this need for system flexibility is common to both the Communist and non-Communist worlds and whether or not there is any chance we can find a common effort to focus on the needs of human beings instead of on systems.

Mr. BALZER. Well, thank you for that easy question, Congressman. I will try to get to it.

It seems to me the interest in Japan is one way, if we approach it properly, of understanding both commonality of needs and differences in cultures. I would say, on the other hand, unfortunately, that there has been a great deal written, for example, about the Yugoslav experience, which has a social democratic experience that is one of the most exciting in the world. And yet there is very little serious attention paid to it.

There was some talk about the German experience, the French experience, some of the English experiences, and there has been a great deal written again about the Swedish experience—and I know Mr. Thorsrud spoke to you about some of the Norwegian experiences. We tend, like the Chinese in this regard, to have a fairly insular view. If it is not invented here, it is not good.

I think the pressure that both Communist and non-Communist societies are finding have to do with the kind of common experience of the spread of these new values, where people feel that authority has less right to dictate their lives, where people have a greater feeling of wanting to have some involvement.

Now, interestingly enough—and I think that will be the nucleus of some of the solutions we find in this country—is that in this country workers seem to be most interested in having some input about the decisions that immediately affect their job, and much less interest with the Europeans or other socialist societies, in higher level kinds of decisions affecting the organization of the total organization. But these problems are common in my experience to all societies, and I would just share with you, of course, the famous Chinese story of the foolish old man and the mountain, which seems to me to be how we need to direct ourselves.

The foolish old man and the mountain, an old man is out every morning clearing some rocks from a mountain in front of him. People start to laugh at him. Finally they start whispering and calling him a foolish old man. One day they say to him, "The mountain is so tall, and you're an old and frail man; you will never move that mountain." And he said, "You do not understand. I am old, but I have children and they will help me, and my children will have children and they will help them, and the mountain will never grow any taller."

I think one of the problems again, if I can move from that, to what happens in this society is that we tend to want—and that tends to go back to TV—immediate answers. We have a kind of fadism in managerial styles because we want answers within 18 months, rather than looking at a process that will help us grow and understand where we need to go.

Mr. **Brown**. You use the term "process" which, of course, can be explored in great detail. The process involved in shifting the value system that you have described doesn't end with the current status of our value systems. There is, probably, a small element in society which has already moved beyond the value system that you have described that concerning personal fulfillment to some different concept. Perhaps you have already explored what some of those concepts may be.

The question is, What are the dynamics of the process basically? How fast is it moving and in what direction is it moving. How can we anticipate and take advantage of the changes or avoid fragmenting ourselves over unnecessary resistence to them?

I don't know that this hearing can explore all of those problems, but it seems to me that the direction in which we are moving, from a selfish or more personal concern with purely monetary reward, on to personal fulfillment, that the next step is bound to be involvement with the larger goals of the enterprise or the society. The most productive work force would then be that which has the opportunity to be involved in the next generation of motivators.

Mr. BALZER. I would agree with you. Again, this gets back to something the chairman said. If I were in an organization, the place that I know I would immediately start work is on the first-line supervisors. I feel that they are inadequately empowered to do a job. They are inadequately empowered to change from the role of policeman to resource. I think more and more people do want to have some sense of this ownership. I think so far we have not been very successful in thinking of new ways. The kinds of ownership we're talking about still are in financial terms generally, whether it is ESOP programs or profit sharing, and our experience is that that sense of ownership is not immediate enough, the kinds of ownership people want going to the direction that you suggest, and that we will have to devote much more attention to that.

Mr. LUNDINE. If you would yield to me——

Mr. BROWN. I'm through, Mr. Chairman.

Mr. LUNDINE. I always enjoy Michael Maccoby's observation of a foreman at the Harmon International Plant in Bolivar, Tenn., who told him he never realized how much power he had until he started giving it up.

Mr. Walgren.

Mr. WALGREN. Thank you.

I just want to ask—and having not been here during your testimony, I apologize if it is covered in great detail there—but just briefly, how would you get the management to look beyond 18 months short term? Do you have any specific suggestions?

Mr. BALZER. Those answers I will have to save for my new book. But seriously, I think some of it goes to—No, I don't have specific answers that solve the problem. I mean, it was alluded to before about the Japanese and the longer range kinds of goals. Part of that, of course, is affected by the difference between the kind of stock market ownership that exists in this country and the kinds of long-term relationships with banks that exists in lending institutions in Japan.

I think if you look at an operational level, I think the only way you get beyond the 18-month forecast is you rebuild the reward structures. Part of the difficulty again I think has to do with the kinds of MBA's that we put out in this society and the kind of business school, that you are getting a mandarin class of professional managers who think they can manage anything. They don't need to care about the products very deeply that they're involved in; they are financial people, and unfortunately, they are also lawyers as well, and they feel that is the kind of knowledge that is needed to run an organization. That breeds it.

The same idea of a fast track, of people needing to move, means that you don't learn to grow and understand the machines that you're helping—you don't have any feeling for the organization. So I think you have come to the heart of one of the problems, which is the real problem, that you have got to attack the kind of 18-month mentality. And I see this in several different ways, if I can spend a minute on it.

Mr. WALGREN. Please do.

Mr. **Balzer**. One is that we have spent a lot of time in the last 5 or 6 years talking about quality worklife programs, the kind of joint labor-management activity. Generally when they begin, we tend to say to some manager, "You have all your other numbers to me, and in addition, we want you to have this program." There are several things that operate.

If you tell them that you really have to sell a process and not a program, you're telling the person you won't see the real change for 5 years, it is very hard for most operating managers to buy into that, because how they do in the organization is based on what numbers they produce, whether it's a quarterly report or annual report or the longest term, 18 months. It is very difficult to change those kinds of rewards. There is a lot more talk about it than doing it. Again, the reason it is so difficult is the way that our corporations are owned. As long as you are pressured by the stock market, you have to answer to the shareholders. Again, I would say you have gotten to the nub of one of the real problems and it is very difficult to attack.

Mr. **Walgren**. In a sense, one of the greatest problems would be the holding of stock options or bonuses by management. That would contribute to that short-term impression of the business not just in terms of promotion for management within the organization, but also in terms of personal wealth and personal worth to others with whom you work.

Mr. **Balzer**. Yes; I agree with that.

Mr. **Walgren**. Did you have anything further you wanted to add on to how to——

Mr. **Balzer**. No. I mean, I just think that is an issue that has to be a concern. Of course, the problem that we have compared to the Japanese is that the Japanese in general make a long-term commitment to organizations. Part of the new values that we talk about is there is more of a commitment to the profession and less of a commitment to the organization. Many of the kind of fulfillment seekers, if you don't offer them a challenge inside the organization, they don't care as much about the organization as they do about having a chance to express that kind of creativity. Of course, whether you're talking about Boston, a sort of 128 ring dance with people moving from one organization to another, or the explosion in Silicon Valley of people being in a firm for a year and a half and leaving, the problem is how do you marry the needs of individuals, which is a different set of needs, and the needs of an organization for a kind of stability maintenance and growth.

I don't have any easy answer to that.

Mr. **Walgren**. The needs of the individual in those circumstances really stem from the system in which they're competing. They leave after a year and a half because either there is an immediately better opportunity or they are rewarded for the velocity in which they move. The truth of the matter is that management ought to be looking at that velocity with the skepticism with which we look at changes or the number of changes in some other areas of life. For example, we could be asking why didn't you hold this job, instead of saying, "Oh, gee, he was able to go from this vice presidency to this vice presidency, so he must be good." The truth of it is, he or she is operating in a framework that is detrimental to the long-run interests of the company.

Mr. **Balzer**. Uh-huh; maybe.

Mr. **Walgren**. It could be, yes, depending on how you define the long-run interests of the company. If that is defined in terms of the immediate reward, for the executive level and the ownership level, then all is well and good.

One of the strangest things is that we make money both on the downside and on the upside. I don't know how you ever get around that.

Thank you very much. I appreciate the testimony.

Mr. **Brown**. Mr. Chairman, could I make one additional comment?

Mr. **Lundine**. Certainly.

Mr. **Brown**. Mr. Balzer, you and Professor Brooks made some parallel comments with regard to the question of organizational stability and flexibility. I made a note with regard to Dr. Brooks, that we have a need for vigorous and diverse social and political experimentation. You made several comments about the need for flexibility or overcoming this tendency toward not changing the inertial characteristics of organizations. That leads me to suggest that perhaps we have neglected the importance of maintaining a capability within organizations for this kind of analysis that would enhance flexibility.

That is, I can see a need for a cadre of, say, social scientists who are concerned with the processes of change, and how to accommodate to them and how to maintain a healthy change within an organizational environment. Yet we seem to devote relatively little attention to that as a role within the organization except insofar as managers are looking at the change involved in enhancing profitability. They don't look at the organization as an organism, an entity with a diversity of needs.

I am wondering if we could do something here to stimulate the greater use of social scientists and scientific analysis for that specific purpose, of enhancing the constructive change.

Mr. **Balzer**. As with most answers, the answer is probably yes and no. It seems to me there would be a great opportunity for a field called organizational anthropology, which would be an effort to both understand organizations as cultures, and how cultures either adapt or reject programs. So, yes, I think there is an opportunity.

No; I think social scientists have had a mixed record in the work in business. I think again the problem with a little teaching is it sometimes backfires. I think the primary example of that, whether you think it is real social science or not, is a lot of the T-group activity that went on in the sixties, which instead of calling someone an s.o.b. you were supposed to smile at him and say "we have a problem here." It caused a great deal of ill feeling on the part of companies about what could be garnered and learned from social scientists.

Also, there is the difficulty between what are called hard and soft and this whole language of line responsibility and staff people. You know, if you're an operating manager, it is because you're responsible to the bottom line. And often you look at social scientists being soft staff people and not bottom line oriented, and if you look at most organizations, the kinds of different power that a vice president for marketing has as opposed to vice president for personnel, you begin to see who has the clout to effect change.

So I think only when we come to an understanding of the real importance of the human factor—you see, we have talked about the importance of the human factor for 50 years. You know, every organization has somewhere in its charter where it says people are the most important part. Most organizations teach people in 1,000 and different ways that it is not true. So only when we become closer to how we think we ought to live will the kinds of things you're talking about, Congressman, have a chance to flower, I think.

Mr. LUNDINE. Mr. Rheem, di ' you have any questions?

Mr. RHEEM. Yes, just one.

In both your spoken and your written testimony you talked about this new breed of worker: younger, more educated, with higher expectations, et cetera.

As the percentage of this new worker of the total work force continues to increase in the American workplace, and with the changes that we are asking managers to make, are these changes simply to preserve the current level of productivity that we have? Are we talking about keeping them from slipping further? Are we talking about increasing productivity of these workers?

Mr. BALZER. I think, Mr. Rheem, you have to talk to all different managers. My experience is that some are talking about holding on; some are worried about further slippage. I think the most innovative companies that you could talk to are, in fact, worried about how they are going to compete in the next 10 to 20 years out, and what they need to do to become more competitive and more productive. I think again it goes to their sense that they really need to understand what the values and attitudes are that people bring to work with them, if they're going to figure out what people want. It's part of a contract.

You see, I think everybody works under a written and unwritten contract, and the unwritten contract is usually more powerful than the written contract. Unfortunately, written contracts usually go the minimums. A labor contract says "you can't produce less than," or we can set a target of "*x*." Usually, unwritten contracts are something to the effect that "if you get what you want from work, you are willing to give of yourself *x* amount."

I think more and more there is going to be more of an acknowledgement that as you can measure less and less sophisticatedly, the kinds of output people get, it still leaves the question that the chairman got to and Professor Brooks got to, about we have an unanswered question about technology; will it be used as a new stage for a new kind of terrorism in the office, or will it, in fact, help with greater freedom.

But there will be more and more attention paid by organizations to this unwritten contract, and I think it is to the ongoing health of organizations that we're going to be talking about.

Mr. RHEEM. Thank you.

Thank you, Mr. Chairman.

Mr. **Lundine**. One of the very important points that Mr. Balzer raises is the definition of productivity, particularly as it applies to the office. My only management experience was as a mayor of a city with 1,200 employees. I think one of the most enlightened things an adviser ever told me is that "you had better watch very carefully how you define productivity, because you're liable to achieve it." The example he gave was of a policeman. If you define productivity by the number of arrests, your productivity will go up.

I am delighted now that we are going to have a witness who has some expertise in productivity measurement and improvement, and also the human factor studies in office and factory productivity. We are also going to have the opportunity to hear, after talking so much about corporations and what corporations ought to do, from a representative of corporate America. Lewis Hanes is the manager of the Human Sciences Research and Development Center of Westinghouse Electric Corp.

However, before getting to Mr. Hanes—and we do welcome you—we are going to have to take a short break so that we can make a vote on the House floor.

The subcommittee will be in recess for about 5 minutes.

[Recess.]

Mr. **Lundine**. The subcommittee will resume these hearings.

Mr. Hanes, we have your statement, and your entire statement will be made a part of the record. You can proceed in any way you see fit. I know that Mr. Brown and Mr. Walgren will be returning, but they have asked me to just proceed.

[The biographical sketch of Mr. Hanes follows:]

Lewis F. Hanes

B.S., M.A., Ph.D., Experimental Psychology, The Ohio State University

Former President and Fellow, The Human Factors Society

Chairman of Working Group on Human Factors and Senior Member, The Institute of Electrical and Electronics Engineers.

Fellow, Society of Engineering Psychologists, The American Psychological Association

Member, Advisory Team on Human Factors to The Director, Federal Aviation Administration Technical Center, Atlantic City, NJ

Adjunct Professor, University of Dayton, 1965-1973; University of Pittsburgh 1975-1979.

Westinghouse Electric Corporation, Pittsburgh, PA, 1973-Present

Manager, Human Sciences; Research and Development Center

Responsible for:

- Human factors studies in support of systems and product development programs.
- Office and factory productivity measurement and improvement studies.

Principal Investigator:

- Research on Productivity Measurement Systems for Administrative Services: Computing and Information Services, National Science Foundation Grant No.APR 75-20546 Final Report, 1978.
- Committee to Define Worker-Related Research for Adaptable-Programmable Assembly Systems. National Science Foundation Grant No. 80-SP-1191, Final Report, 1980.

NCR Corporation, Dayton, Ohio, 1965-72.

Manager, Human Factors; Research, Development and Engineering Responsible for studies in support of systems and product development programs with emphasis on projects to improve worker productivity and effectiveness in operating and maintaining business equipment systems.

Ritchie, Inc., Dayton, Ohio, 1958-1965 --- Senior Associate; responsible for human factors aerospace and military programs.

STATEMENT OF LEWIS F. HANES, REPRESENTATIVE OF THE HUMAN FACTORS SOCIETY AND MANAGER, HUMAN SCIENCES, WESTINGHOUSE RESEARCH AND DEVELOPMENT CENTER, WESTINGHOUSE ELECTRIC CORP.

Mr. Hanes. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I appreciate the opportunity to testify before these very important hearings. They certainly are of great relevance and importance to the Human Factors Society, which I represent, and also to me in my professional work. I will this morning highlight my testimony and then near the conclusion I will give you a couple of examples that are not included in the testimony with regard to some of the research projects that we have performed, to show how we have been involved in research within Westinghouse.

My testimony will include discussions of productivity and its measurement, approaches to productivity improvement, and research needs related to robotics based on the efforts of a committee that was funded by the National Science Foundation. This committee was concerned about the forthcoming introduction of robotics into American industry, and the lack of focused research that is presently in place. Also during the presentation I will identify several areas for possible research.

Productivity may be defined as the output of goods and services produced by a given input of resources, which includes the human labor, the capital, materials, and supplies. This concept of productivity has been applied extensively in manufacturing industries, where the input and output factors are quite quantifiable.

The output per man-hour measure compiled by the Bureau of Labor Statistics is probably the best known example of a productivity index. Attempts have been made to apply the productivity concepts developed for manufacturing to the service sector of the economy. The results have not been nearly as successful.

There are a couple of major difficulties. One difficulty is quantifying the output; that is, what is the value of a computer center? Also, there is this whole area of effectiveness, because we can characterize productivity as being related both to the efficiency and also the effectiveness of the operation.

Now, efficiency is the extent to which the outputs are achieved with minimum resources or inputs. Most of the traditional productivity measurements have been concerned with efficiency. The effectiveness of an operation, however, may be of the utmost importance. Effectiveness may be considered to be addressing this question: Is the organization doing the right thing—not how well is it doing whatever it is doing—but is it doing the right thing?

As an example, a computer center may be very efficient in using its resources to produce the output. It may be a very efficient computer operation. But if it is not producing the kind of information and data that are required by the users of that particular computer center, then it is not effective at all.

It seems to me that one of the most important problems requiring research today is measurement of administrative services and knowledge worker productivity levels. This was discussed by one of the previous witnesses. The difficulties, as I said before, are in quantifying the goods and services output by such workers, and in assessing the effectiveness of their efforts. How is the goodness or value of an engineering technical report quantified—as an example?

Without measurement, it is not possible to determine if a given productivity improvement project has had any effect. With the expected increase in the number of administrative services and knowledge workers—and there are some who would claim that within not too many years more than half of our work force would be involved in these kinds of activities—how are we really able to know whether productivity improvement techniques work.

I would like to move on now and briefly mention five general approaches that are used to improve productivity. Of course, productivity programs typically include elements from more than one approach.

The one approach that has received the most attention, and probably has accounted for about half of the improvement in the U.S. productivity in the last 50 years—or at least the last 35 years—relates to substitution of equipment for human effort. It has been successful because the technological developments have provided the equipment. We find the capital has been available to implement, and the work force has been willing, by and large, to introduce these changes into the workplace.

The second major area is better utilization of human resources. It involves higher levels of productivity with the existing work force. There have been many techniques applied, such as training, pay incentive systems, and human resource management. A technique that is receiving considerable attention today is worker participation. The quality circle program is one example.

A third approach that probably accounts for the second largest increase in productivity in the last 25 years relates to improved work methods and aids. It involves application of such techniques as facility management, task analysis, job design, to provide an efficient flow of work and efficient worker job performance.

A fourth area relates to improving design of systems to accommodate the user. It involves designing both the equipment and the environment, taking into account the physical and mental capabilities and limitations of the people involved with the system. It is expected that this area is going to become even more important in the future because as we do move into new technology areas, we find there is much more flexibility in the designs that are possible.

The last area that I will mention relates to removal of unproductive regulatory labor and organizational practices. It is probably the most controversial of those that are identified, and many times is the most difficult to implement.

It is expected that much effort will be applied to the development of equipment that can substitute for human effort in the future. The potential improvement in productivity is high through this approach. But to turn the potential improvement into actual improvement, the affected people must be considered during the design of the production system.

Studies are required on work methods and aids and on the design so as to accommodate the expected users. A research program concerned with the relation between worker participation and productivity levels is needed. Participation programs are being introduced on a wide scale in industry. Research is required to evaluate the effectiveness of these programs. The results will provide the basis for preparing guidelines that define which programs are effective, under what conditions. This knowledge is important as we move toward significant changes in the workplace. It seems to me this is really a very important area.

In the past we have seen fads. We have seen the introduction of T-groups that were mentioned before. There have been a number of human resources kinds of projects that have been introduced into the workplace, and after upper management loses its interest in that particular approach, then management moves on to some other fad, if you will.

The quality circles are in a similar vein. It is theory Z management in a similar vein. It seems to me that we need to perform research; we need to be aware of what is going on in other countries, which this subcommittee is addressing. But we also need to be very much aware of what is going on in the United States and in North America because there really are some very important lessons that industry and government is providing. We need to set in place mechanisms that we can identify what works and what doesn't work; what are the important factors within a program that makes it result in higher productivity and more innovations. Those things that don't work, then we ought to discard them. We ought to package these results in terms of guidelines and disseminate these, because it is only when we have this information in a form that management can understand and can use and the value has been demonstrated can we expect for those programs that work to be institutionalized and remain for long periods of time, not just for a few years until something with a little more glitter comes along.

I would now like to spend just a few minutes highlighting the results of a committee that I was involved with.

At the Westinghouse Research and Development Center a few years ago there was a program, which is ongoing, relating to the development of what has been called adaptable-programable assembly system, or APAS is the acronym we sometimes use. This is an assembly system that would be programable, so that one could change the parts that are going through, the equipment that is being manufactured, quite easily. The changeover would simply be a programing changeover.

This program, by the way, is funded in part—rather extensively, in fact—by the National Science Foundation.

There is an advisory group to that particular program, and members of the advisory group raised a very important issue a year or two ago, and that is that there wasn't the attention being given to the worker in the development of this system. There is a lot of attention given to the technology, to the hardward and software, but there really wasn't the attention given to the worker. So NSF funded a committee to address the very topic. I am going to describe some of the highlights of that study right now.

The committee consisted of people from universities, from a union, from the robotics and automation area, human factors, social technique areas. It was very interdisciplinary. The team then met for 4 days with the charge of defining major human-related problems and advantages of the new technology. On the basis of these definitions, the committee identified areas of research.

The first question addressed by the committee was "What do you consider to be the major people-related problems involved in introducing APAS-like technology in American factories?" I will identify just a few of the more important problems that the group surfaced.

Resistance to change was the top item. This is certainly of great concern. It is natural for people to fear and resist change, particularly when the changes promise to affect their livelihood. This technological change may have a basis in reality, that is, in a loss of jobs or job change, and it may be involved not to expend energy, to retrain, to learn something new. Certainly fear could be a very important factor, fear of what may happen, whether or not the change does occur.

The widespread adoption of robotic equipment may demand an accompanying widespread development of new skills among employees—that is, not only the people who operate the equipment, but the maintenance personnel, the troubleshooters, the designers of the systems, and also the supervisors.

Human factors issues related to allocation of functions between the equipment and the operator are critical. What will the worker's role be as he or she interfaces with robotic equipment. To what extent will the worker be involved with and bear responsibility for operations? Who will be the "robot," the equipment or the operator?

The whole area of training will need to be addressed. A selection system will need to be established to determine who should be trained for which jobs. The extent to which seniority, union contracts, equal employment opportunity, and other guidelines may apply will need to be determined. The costs of training will need to be investigated, along with methods of financing training. Who will bear the costs—the company, the worker, or the Government? How will the local community be affected?

The method of renumeration certainly can affect motivation. Workers may expect and demand that pay scales be revised to reflect increased skill.

Certainly there are subjective reactions. The attitudes that have been talked about earlier this morning are of high importance. They need to be considered. Will the workers find satisfaction with their job; will they consider themselves to be managers of the assembly system rather than human robots in the production system; will they express their alienation through absences, as we heard about earlier this morning; turnover, even sabotage may occur. What will the relationship between the workers and the supervisors be? Will it change or will it be similar? What is the effect on the worker's mental health, both on and off the job? How will the quality of life be affected?

A comprehensive definition of people-related research areas must include positive as well as negative effects of robotic equipment. We tend to emphasize the negatives, but on the other hand, there certainly may well be some positive aspects with the widespread adoption of technology, not only into the factories but also in the offices. I would certainly like to emphasize that point. In the near term we're talking about factory automation; certainly office automation is moving ahead at a rapid pace, also, maybe a little slower than factories, but it's coming.

The question that we asked the committee that concerned the positive aspects is as follows: What do you consider to be the major people-related advantages that may result from the introduction of APAS-like technology into American industry? The main point that came out was that American industry may well be helped to remain solvent and competitive, and to gain a larger share of the international market. We have tremendous resources in the United States. We have exercised this capability in the past. There are areas where we are still world leaders in terms of production—the aircraft industry, the computer industry and so on. We are still in very good shape there.

The widespread adoption of the new technology, plus incorporating the human resources may well result in our resurging in terms of the capabilities of the United States. So I think we can't put our heads in the sand and ignore these changes. We actually have to face up to them and we have to be in a position to move forward and do it in a proper way.

The demands of the new technology will create opportunities for improvements in workers' status and pay. A market for new skills will develop. Workers who are inspired by the possibilities inherent in the new work environment may choose to upgrade their skills through further study and training.

The improved job environment and the release from dangerous, dirty, and tedious physical work may improve worker morale and encourage the development of professional attitudes. As the quality of worklife improves, workers may develop a sense of community and pride. Part of a worker's satisfaction with his or her job may also stem from a renewed sense of national pride as the position of American industry in the international market improves.

At present, manual work on a conventional assembly line is paced by the speed of the machinery. This setup, by requiring unfaltering attention and movement of the worker, may cause physical and mental stress. The new equipment will place the worker outside the flow of the assembly line. Because the tasks will be supplemental rather than integral to the assembly movement, the worker will be able to create his or her own work pace. The stress created by timed, repetitive movements will be reduced.

Of course, on the other hand, when the equipment fails, one may have a great deal of pressure to get it online again because of the capital investment.

The committee identified areas of reseach to accompany an early test of this adaptable programable assembly system, and also for identifying important research areas beyond the scope of these tests.

Because it is important that worker problems not be defined nor solutions proposed from a narrow perspective, research teams composed of experts from the affected fields should collaborate with robotics systems designers to produce the kinds of studies that are required. Certainly the results would aid in developing more acceptable designs and implementation plans.

As far as specific studies, we really need to emphasize the retrospective analyses, it seems to me. Some organizations have been very successful in the past and at present in introducing significant changes in the workplace, in the factory and offices. We ought to look at the good experiences and the bad. We ought to have a research program that does just that. What kind of guidelines can we develop from the experiences of the past. I would certainly emphasize the United States as well as other countries in this regard.

Also, we ought to have case studies prepared as industry moves forward, as the technology is introduced. What are the problems faced? What are the approaches that work? Do the quality circles, in fact, result in greater adoption and a smoother introduction of change into the factory and into the office. In other words, what are the guidelines that can be developed.

We need to package these. We need to disseminate the good results, and we need to discard the bad ones. A study should be performed to develop estimates of future manpower needs. Both the types of skills and the number of persons required by skill level should be estimated. The estimate should include all jobs created by or affected by the robotics technology. A comparison needs to be made with the existing manpower skills to determine what the training requirements really are, and also what the displacement issues may be.

A worker research study is required to identify worker selection criteria and training needs and methods. What number of workers will be required by what skill levels? How do we select those people? How do we train them?

We should also have a research program concerned with human factors issues involved in operating and maintaining an advanced robotic equipment. The program should be conducted during the development of the systems, during initial tests of the technology, and during initial operations in the factories. The functions required to make the system operate should be analyzed. Functions should be allocated between automatic equipment and workers based on the relative capabilities and limitations of each. Task analyses would be performed on worker functions to provide the data required to begin the manpower needs and selection and training studies. The human factors evaluation of the system during technology tests and initial factory installations would verify adequacy of the design and identify problems and solutions.

In closing my formal testimony, I want to emphasize that the human factor should not become the forgotten factor in productivity improvement. Much relevant knowledge is already available, but more must be developed through research. It is very important that we have research soon.

Proper consideration must be given to the utilization of people, their participation in the change process, and the design of factory and office systems based on worker capabilities, limitations and motivations. It is very important that these studies be mounted, because productivity improvement is so very important to our nation.

With your permission, Mr. Chairman, I will relate one or two brief examples. One relates to a forging operation at one of the Westinghouse plants, where it was a very hot, stressful situation. The workers are required to work with pieces of metal that are 2,100 to 2,200° Farenheit, white hot. It is necessary to move these. In the past it has involved lifting—they weigh 60 or 70 pounds—lifting these and moving them from a furnace into a forge press and then removing them from the press after the operation.

The question was raised in my group—and the Westinghouse Research Center got involved—whether the workers were being asked to do too much or too little. In this particular situation, we used knowledge which is in the work physiology area. Many people run, exercise, and you may be aware that in the sports physiology area information is available on what we can expect of people in terms of their cardiovascular capabilities. We took that kind of information and we applied to the people in the forge shop. We looked at their heart rates; we looked at the amount of oxygen they were consuming while performing these tasks, and we identified whether or not they were exceeding their own physical capabilities. This information was used for some of the industrial engineering techniques of time and motion; that is, what are the standards that this job involves.

We were able to identify areas where people were, in fact—well, I shouldn't say they were being asked to do too much. They were working up close to their limits. They really weren't being asked to perform more than they were capable of performing.

But the interesting thing is that this particular study provided a basis for an evaluation of the introduction of robotics into this particular work situation. In fact, robotics were introduced and there was very close cooperation with the work force throughout. The workers were talked with prior to the studies. As the studies were completed, the results were made available to them. They had an opportunity to input and, as I understand it, the introduction to robotics has gone very smoothly. The workers no longer have to do the dirty, demanding, hot job that they had to before. So that is one example where some of the kinds of research that is available on work physiology, on methods analysis, human factors data base, were applied to a real world problem and robots were introduced without much trouble.

The second example deals with a computer center right here in Washington. Westinghouse has a division that manufactures and sells open-plan furniture. My group has been involved for several years in trying to measure and evaluate the productivity of workers who might move from the "bull pen" office configuration into the open-plan furniture. We worked with one of the major banks here in Washington where there was a group of about 30 programers and systems analysts who made that move. And by carefully measuring their output before and after the move, by performing attitude surveys that have been talked about before, we were able to establish—and in this case there was significant improvement in worker productivity. At least we have some insights as to the reasons for the improved productivity.

Now, with that kind of knowledge, we can disseminate the results. That is, we can talk about how to measure productivity for certain kinds of computer center operations; we can identify some of the reasons that moving from a bullpen configuration to the open plan that involves six vertical panels with the desks suspended on the panels, why these can improve productivity.

Thank you.

[The prepared statement of Mr. Hanes follows:]

STATEMENT ON HUMAN FACTORS AND PRODUCTIVITY BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

Lewis F. Hanes, Representative of The Human Factors Society
and Manager, Human Sciences,
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September 10, 1981

I am Lewis F. Hanes, a representative of The Human Factors Society, and Manager of Human Sciences at the Westinghouse Electric Corporation Research and Development Center.

I appreciate your invitation to present testimony at these hearings on "The Human Factor in Innovation and Productivity." This topic is of great interest to the Human Factors Society and to me personally.

The Human Factors Society is a professional group with more than 2500 members. Many of the projects performed by its members are directly related to improving productivity.

I am involved in research related to productivity. This work has been stimulated by a recent research project performed under a National Science Foundation (NSF) grant. In this study we formed a committee to identify needed worker-related research for adaptable programmable assembly systems.

My testimony will address some of the important issues related to human factors and productivity. It will include discussions of productivity and its measurement, approaches to productivity improvement, research related to robotics based on the NSF committee efforts, and additional areas for research.

PRODUCTIVITY AND ITS MEASUREMENT

Productivity may be defined as the output of goods and services produced by a given input of human and other resources. It may be measured in terms of the ratio of output to input.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

The productivity concept has been applied extensively in manufacturing industries, where the output and input factors are generally quantifiable. The factors are normally expressed in dollars and hours, or equivalent. The output per man-hour measure compiled by the Bureau of Labor Statistics is probably the best known example of a productivity index. This index is calculated by dividing constant-dollar gross national product by labor hours employed in the private sector of the economy.

Industrial and human factors engineers sometimes find that the economic expressions of productivity at the company or national level are not very useful in their work. It is helpful to consider productivity at the small group or even individual worker level. At such a level individual factors can be examined to determine their effects on productivity.

Attempts have been made to apply the productivity concepts developed for manufacturing industries to the service sector of the economy. The service sector includes business and institutions concerned with government operations, health, finance, education, and personal services. The results generally have not been adequate. A major difficulty is in quantifying the value of the output term -- the goods, services and products produced.

Productivity may also be considered as the product of efficiency and effectiveness. If either term is zero or low, then the productivity of the organization is zero or low. Efficiency is the extent to which the outputs are achieved with minimum resources or inputs.

Most of the traditional productivity measurements are of efficiency. Effectiveness of an operation, however, may be of the utmost importance. Effectiveness may be considered to be the extent to which an organization has selected and accomplished the proper objectives and programs. Effectiveness measurement has been especially difficult. How is the "goodness" or value of an engineering technical report quantified?

APPROACHES TO PRODUCTIVITY IMPROVEMENT

There are five general approaches used to improve productivity. Of course, productivity programs typically include elements from more than one approach.

1. Substitution of equipment for human effort. This approach has been responsible for major increases in productivity levels during the last 30 years. It has been successful because technological developments have resulted in equipment availability, capital has been available to acquire and install the equipment, and the work force has generally accepted the change. This approach is receiving world-wide attention because we are at the threshold of a possible major shift in manufacturing to increased substitution of equipment for human effort. Further in the future we would expect to experience a similar substitution in many administrative and service job sectors.

2. Better utilization of human resources. This approach has received much attention throughout the years. It involves achieving a higher level of productive output with an existing work force. Many techniques have been developed and applied in attempts to realize higher productivity through this approach. Examples include the threat approach (produce more or be terminated), pay and incentive

systems, worker and supervisory training programs, and human resource management. A technique receiving current attention is worker participation, such as through quality circle programs. Theory Z has emerged as a management style emphasizing participation as a vehicle to achieve better utilization of human resources.

3. Improved work methods and aids. Some would argue that this approach has accounted for the second largest increase in productivity during the last 30 years, exceeded only by substitution of equipment for human effort. It involves application of such techniques as facility arrangement, task analysis and job design to provide an efficient flow of work and efficient worker job performance. The approach has been successful in improving productivity because human factors and engineering disciplines have developed the techniques, management has installed the techniques, and the workforce has generally accepted the changes.

4. Improved design of systems to accommodate users. This approach involves designing equipment and environment taking into account the physical and mental capabilities and limitations of the people involved with the system. For example, the design of a computer terminal for extended data entry should take into account the size of the expected users, the characteristics of the visual display to minimize eye fatigue, and the operating functions that should be automated or manual. The human factors discipline has developed knowledge and techniques upon which this approach is based. The approach has been applied during the last 30 years, but is expected to become more important with increased utilization of new technology in offices and factories of the future.

5. Removal of unproductive regulatory, labor and organizational practices. This approach is often controversial and difficult to implement. It involves removing or modifying practices that inhibit or detract from productivity and that are no longer needed. The practices may be based on government regulations, labor agreements, or organizational policies.

RESEARCH RELATED TO ROBOTICS

Background

The use of automation in industry is entering a phase leading to what has already been described as a second industrial revolution. The basis of this revolution is the microprocessor, which is making possible the design of assembly-line equipment with a new type of flexibility. The latest generation of computer-controlled equipment is not limited to one task, but can be programmed to perform a variety of tasks. As a result, it will become less necessary for a plant to house machinery for various product models or to shut down production for retooling. Changes in production schedules can be accommodated by a programmable system.

The most advanced robotic equipment is adaptable as well as programmable. It includes sensory devices that can detect slight displacements and faulty parts and make automatic adjustments. It operates at faster speeds than human workers, and because it has the potential for fewer errors, it may use less material and produce less waste.

This robotic equipment obviously offers many attractive advantages to manufacturers. Primarily, it offers a means of increasing productivity and decreasing production costs. It is viewed by some as a partial solution to the problem of declining American competitiveness in the world market.

Robotic equipment will take over not merely the dangerous and difficult jobs but also the desirable jobs of skilled workers. It is expected that job loss will be greatest in batch assembly -- i.e., in assembly of fewer than 100,000 units -- which presently comprises about two-thirds of U.S. manufacturing.

Job loss will not necessarily result in unemployment, but it will involve displacement as workers find themselves required to shift to new jobs. The tasks in the new jobs, the training required, the new work conditions, changes in the worker's role in the plant system -- all these and many more facets of change need to be examined in order to provide an information base for intelligent planning for people and equipment.

To date, most research in robotics has been limited to the technological aspects, i.e., to the development of hardware and software. The impact of the technology on individuals, on the economy, and on American society in general has not been studied very much. To prepare for the expected changes, the human implications of robotic technology need to be assessed. Research programs should be established where the knowledge base is not adequate to address the expected problems.

Formation of Commitee

In response to the need for an assessment of worker-related research in conjunction with robotic technology, a committee was formed to define the areas in which research should take place. Such a committee was first suggested at a meeting held in April, 1980. The meeting included a review of the adaptable-programmable assembly system (APAS) being developed by Westinghouse Electric Corporation under NSF sponsorship. Meeting attendees concluded that simulated production tests of APAS offered a unique opportunity to perform important worker-related research studies. The formation of a committee to determine the appropriate areas for research was recommended.

Under NSF sponsorship, the committee was formed and held a meeting in August, 1980. The group initially defined major human-related problems and advantages of the new technology. On the basis of these definitions, the committee identified areas of research to accompany the APAS tests, and important research areas beyond the scope of the APAS tests.

The committee was organized to represent a wide range of knowledge, experience and expertise. It included representatives from universities, a labor union, a consulting organization, and a major industrial company. The skills of the participants covered socio-technical, systems engineering, industrial engineering, human factors, robotics engineering, plant management, personnel relations, and union relations areas.

Worker-Related Problems

Before attempting to determine the areas of worker-related research, the committee reviewed potential human problems which may accompany widespread adoption of robotics technology. In response to the question: What do you consider to be the major people-related problems involved in introducing APAS-like technology in American factories?, the committee produced a list of 22 possible problems. Some of the more important of these problems are identified below.

Resistance to change was identified as a very important problem. It is natural for people to fear and resist change, particularly change that promises to affect their livelihood. Resistance to technological change may have a basis in reality -- real job loss, real job change. It may stem from a desire not to expend energy to develop the capabilities required by a new job situation. It may be caused by resentment of the new equipment. Much resistance will have a basis in fear -- fear of the unknown effects of the new technology, fear of job loss, fear of job change. Rumors preceding and accompanying introduction of robotic equipment can exacerbate these fears. The possibility exists that the resistance to change may become organized.

The widespread adoption of robotic equipment may demand an accompanying widespread development of new skills among many employees -- equipment operators, troubleshooters, maintenance personnel, product designers, and supervisors. There may be an increased specialization of tasks, resulting in job polarization -- i.e., a predominance of jobs requiring high or low level skills.

Human factors issues related to allocation of functions between the equipment and the operator are critical. What will be the worker's role as he/she interfaces with robotic equipment? To what extent will the worker be involved with and bear responsibility for operations? Who will be the "robot" -- the equipment or the operator? The design of software and the engineering of input and output devices will be very important.

The whole area of training will need to be addressed. Since it is assumed that initially most training will be retraining of existing employees, a selection system will need to be established to determine who should be retrained for which jobs. The extent to which seniority, union contracts, Equal Employment Opportunity, and other guidelines may apply will need to be determined. Preparation will also have to be made for the training of new employees to replace those that leave. The costs of training will need to be investigated, along with methods of financing training. Who will bear the costs -- the company? the worker? the government?

The method of renumeration can affect motivation. Workers may expect and demand that pay scales be revised to reflect increased skill.

A large body of technological and human data will need to be developed based on evaluation of APAS-like systems. This data should be disseminated to facilitate technology transfer and establishment of guidelines for industries that use robotic equipment.

The subjective reactions of people who work with robotic equipment should be studied. Do they find satisfaction in their jobs? Do they experience pride in their work? Do they evidence alienation by such things as turnover, slowdowns, absences, or sabotage? Is the relationship between workers and supervisors changed? What is the effect of the new environment on a worker's mental health? Both on and off the job, how is the "quality of life" affected?

The physical health of workers must also be examined. As with the introduction of any new equipment, devices must be designed and procedures established to protect workers in hazardous situations. Workers will need to be trained in new safety practices.

The introduction of robotic equipment into part of an existing plant may force changes in other parts of the plant, e.g., requirements for tighter tolerances, cleaner parts, and less variable raw material.

The danger also exists that the new equipment will become isolated from the rest of the operation, both technically and socially.

Worker-Related Advantages

A comprehensive definition of people-related research areas must include positive as well as negative effects of robotic equipment. Because the committee's list of problems emphasized negative effects, a question was presented to focus attention on positive effects: What do you consider to be the major people-related advantages that may result from the introduction of APAS-like technology into American industry? The committee produced a list of 12 items in response to the question. Some of the more important advantages are discussed below.

An anticipated increase in productivity will have many desirable effects. American industry will be helped to remain solvent and competitive and to gain a larger share of the international market. Industrial workers will benefit from the resulting improvement in the job market. They may also find that they can work the same hours with more pay, fewer hours without a reduction in pay or, in some cases, with an increase in pay.

The demands of the new technology will create opportunities for improvements in workers' status and pay. A market for new skills will develop. Workers who are inspired by the possibilities inherent in the new work environment may choose to upgrade their skills through further study and training.

The improved job environment and the release from dangerous, dirty, and tedious physical work may improve worker morale and encourage the development of professional attitudes. As the quality of worklife improves, workers may develop a sense of community and pride. Part of a worker's satisfaction with his/her job may also stem from a renewed sense of national pride as the position of American industry in the international market improves.

At the present time, manual work on a conventional assembly line is paced by the speed of the machinery. This set-up, by requiring unfaltering attention and movement of the worker may cause physical and mental stress. The new robotic equipment will place the worker outside the flow of the assembly line. Because the tasks will be supplemental rather than integral to the assembly movement, the worker will be able to create his/her own work pace. The stress created by timed, repetitive movements will be reduced.

Noticeable improvements may be possible in the workplace. Because the equipment is new and developing, with no traditions of past practices, good interface design can be achieved rather than merely partial retrofit, as occurs when improvements are made on conventional machinery.

Needed Research

The committee identified areas of research to accompany an early test of an APAS, and important research areas beyond the scope of the APAS tests. These results are presented in the Final Report of the NSF project, published in November, 1980 (see References). The discussion presented below is based on committee discussions and recommendations.

Because it is important that worker problems not be defined nor solutions proposed from a narrow perspective, research teams composed of experts in such fields as labor relations, job training, human factors, and organizational change should collaborate with robotics system designers to produce socio-technological research studies of the new equipment. Study results would aid in developing more acceptable robot designs and implementation plans.

There will be studies in laboratories and factories to test and debug the advanced robotics technology. It is important to perform research studies related to the people who will be working with this equipment in conjunction with the technology tests. It is recognized that personnel are integral to the success of the system even though the goal is self-contained assembly uninterrupted by humans.

Retrospective studies should be performed on organizations that have already experienced some degree of advanced technological change. The effects of different approaches could be analyzed to determine good and bad features of each approach. It may be possible to develop a set of useful guidelines about socio-technical concerns based on the "lessons-learned" from these studies.

Case studies should be prepared containing observations and analyses of the experiences of organizations and individuals at every stage of implementation of the advanced robotics technology. Such studies, like the retrospective studies, would provide guidelines to aid in future implementation efforts. Also, analysis of implementation would reveal the major problems experienced. Research studies could be performed on the most important of these problems. Results would be expected to facilitate future installations.

A study should be performed to develop estimates of future manpower needs. Both the types of skills and number of persons required by skill level should be estimated on a yearly basis. The estimates should include all jobs created or affected by the robotics technology. A comparison of needs with the existing manpower skill distribution would permit assessment of training requirements and displacement problems.

A research study is required to identify worker selection criteria and training needs and methods. The manpower study will identify the number of workers required by skill level. A system based on valid selection criteria is needed to identify who will be assigned to each job. A training program to develop required capabilities in new and displaced workers must be developed. The costs of training should be investigated, along with methods of financing.

One research program should be concerned with human factors issues in operating and maintaining an advanced technology robotic system. This program should be conducted during the development of the systems, during initial tests of the technology and during initial operations in the factories. The program would include developing and applying human factors guidelines specific to the robotic systems. The functions required to make the system operate should be analyzed. Functions would be allocated between automatic equipment and workers based on the relative capabilities and limitations of people and equipment, and on economic and safety considerations. Task analyses would be performed on worker functions to determine the number and kind of physical and mental activities required to perform the jobs. The task analysis would provide the data required to begin the manpower needs and selection and training studies. It would also provide data upon which the worker display and control requirements would be based. The human factors evaluation of the system during technology tests and initial factory installations would verify adequacy of the design and identify problems and solutions.

GENERAL RESEARCH NEEDS

The previous section contains a discussion of research projects needed to support the widespread introduction of robotics technology. There are two additional high priority areas requiring research. They are concerned with productivity measurement and worker participation.

One of the most important problems requiring research is measurement of administrative services and knowledge worker productivity levels. The difficulty is in quantifying the goods and services output by such workers. Without measurement, it is not possible to determine if a given productivity improvement project has had any effect. With the expected increase in number of administrative service and knowledge workers, the ability to provide productivity improvement techniques that work is essential.

The measurement research also should consider the assessment of effectiveness. It is important that appropriate metrics be developed to determine if the proper work is being accomplished together with how efficiently that work is being performed.

A research project concerned with the relation between worker participation and productivity levels is desirable. Participation programs are being introduced on a wide scale in industry. Research is required to evaluate the effectiveness of these programs. The results will provide the basis for preparation of guidelines that define which programs are effective in improving productivity under what conditions.

CONCLUSION

In closing, I want to emphasize that the human factor should not become the forgotten factor in productivity improvement. Much relevant knowledge is already available, but more must be developed through research. Proper consideration must be given to the utilization of people, their participation in the change process, and the design of factory and office systems based on worker capabilities, limitations and motivations. The professionals in The Human Factors Society look forward to the opportunity to participate in performing important research studies and in applying these results together with the existing knowledge to achieve the productivity improvement so important to our nation.

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Mr. LUNDINE. Thank you very much.

I am particularly interested in your testimony about the APAS study, which assesses the effect of new technology on the worker.

Will this committee that you described be involved in implementing the plant change when that time comes, or is it simply a research study to help with the design of the implementation?

Mr. HANES. The committee is now dissolved. The purpose of the committee was to identify research areas at the suggestion of the National Science Foundation. The results of this study are being disseminated on a rather wide basis, and it is hoped that other organizations will attend and address research issues that were identified in this study.

Mr. LUNDINE. One thing I didn't understand. Is that just within Westinghouse, or was that a multi-industry study?

Mr. HANES. You're speaking of the committee?

Mr. LUNDINE. Yes.

Mr. HANES. The committee involved three people from various universities, a member from a union—in fact, the assistant research director was from a union based here in Washington, and other people then from Westinghouse. And one person from the Human Factors consulting firm. So there were about five people on the committee who of the nine were non-Westinghouse participants.

Mr. LUNDINE. Once the APAS technology is implemented, though, what is going to be the role of the worker in implementing that change? On page 10 of your testimony you state that experts in such fields as labor relations, job training, human factors should collaborate to produce sociotechnical innovation. Then you indicate that there will be studies in laboratories and factories to test and debug the advanced robotics technology.

What I wondered, are the workers themselves being asked about the bugs in the system?

Mr. HANES. Yes, they definitely need to be involved. Their input needs to be provided during the planning for tests of that kind, and also throughout the testing process. Their inputs and their comments are most useful. It is very, very important that not only the so-called experts have an opportunity to provide assessment, but those who are directly affected definitely need to be participants.

Mr. LUNDINE. I fully agree with you, that robotics can be a tremendous advancement in the quality of working life, and your forge example is outstanding. Anybody that has been in a forge can appreciate that a worker could have his quality of working life enhanced considerably by the introduction of technology to do some not only repetitive but, as you pointed out, strenuous tasks.

But I really am concerned about the National Science Foundation with regard to whether they are willing to fund research that involves implementing and not just providing some data about some of the effects on workers of implementing new technologies.

Did you have any observations from the NSF in support for this type of study?

Mr. HANES. Well, I believe there is a gentleman here——

Mr. LUNDINE. Yes; I will ask the Director, you can be sure of that.

Mr. HANES. I have been involved, I believe, in three NSF programs in the last few years relating to productivity improvement, and I certainly have been very impressed with the caliber of expertise that is available within the NSF. It seems to me the skills and capabilities that are resident within that organization could certainly do more in this area, and obviously they have funding problems——

Mr. LUNDINE. I have heard about them, too.

Westinghouse has been one of the leaders of American corporations exploring new modes of work organization and sociotechnical design.

One of the issues raised in these hearings is that there is still a great deal of resistence among American corporations to this kind of change. Could you describe the factors that might have led Westinghouse to explore this area while many other companies have not?

Second, I want to ask a related question: Could you suggest any steps that the Government could take to reduce corporate resistance based on your firsthand experience of management attitudes?

Mr. HANES. With regard to the first question, I am a representative of the research center and, therefore, I am not involved in the upper corporate management decisions. So I really can't say very much about that.

I would comment that the very top management of Westinghouse—and I believe Mr. Danforth testified before this subcommittee several months ago—have had a great regard and have recognized the importance of this whole area of productivity. Westinghouse is one of the leading companies in the country in introducing quality circles. The very top management is very much concerned about this whole area of productivity improvement and certainly is addressing it.

I really can't say much beyond that in terms of what drives our upper management to address these problems and to introduce the changes.

With regard to the role of the Government in stimulating, it seems to me that a need exists to provide funding for research programs that cut across a given company. A given organization ought to be funding research in its own groups to develop the knowledge so it can improve its own productivity. I think it's very important. But at a higher level, the more advanced kinds of research that need to be performed, that may be beyond the near-term interests that many organizations have that were discussed just a few minutes ago in earlier testimony. But the Government can play a role in identifying the major research areas, and I have tried to identify some in my testimony that to me are important—provide funding through appropriate mechanisms. This certainly could be the NSF or other organizations. The Department of Defense obviously has a tremendous interest in productivity of its work force. There may well be opportunities for research to be funded there. So there are organizations within the Government that should be and are concerned about productivity, and it would seem to me that these groups provide a mechanism by which the research funds can be provided, but the research really ought to deal with the longer term kinds of issues and not the short term or near term.

Mr. LUNDINE. Mr. Brown.

Mr. BROWN. I am going to make a dogmatic and controversial statement, and then ask you for a rebuttal.

You gave examples of the application of human factors research in the forge and in the office setting, and indicated that as a result of a shift to a more desirable format you achieved measurable improvements in efficiency.

My dogmatic statement is, from what you have told me, I don't think your experiment included sufficient controls to justify any conclusions. For example, say you had taken the same group of people and put them in a worse environment. In accordance with the Hawthorne effect, you might very well have gotten the same improvements in efficiency under some circumstances. I would like to know what about that research justifies your citing it as an example of good human factors research.

That's a dogmatic and controversial statement.

Mr. HANES. I will provide a brief reply.

In this particular study, the workers were not aware of the measurements that were being taken in terms of the output that they produced. That is, in this particular situation, the workers coded information, and the computer system collected data with regard to each individual on a weekly basis. We in this particular situation had two groups of workers, one of which moved about 3 months before the other group. They both were performing the very same tasks, and we found the one group that made the move improved in productivity; the second group that did not make the move did not.

After 3 months, the second group moved. It realized an increase in productivity level subsequent to the move, whereas the first group that had made the move did not. So we had a design where one group moved independent of the other and one provided control for the other group. The computer programing systems analysts weren't really aware that the computer records were being analyzed in terms of productivity. They knew a productivity study was going on, but they didn't really know, other than the surveys that we administered, how we were measuring. So there was——

Mr. BROWN. That might be the difference in obviating the Hawthorne effect, then?

Mr. HANES. Yes, sir.

Mr. BROWN. Could you discuss fruther your definition of productivity as the product of efficiency times effectiveness. You have hinted at the difficulty of measuring effectiveness? I am reminded of our situation with regard to American agriculture. We have the most efficient agriculture in the world in which farmers are going broke very rapidly. The problem of productivity in agriculture becomes rather confused under these circumstances. It seems that, in this situtation the more efficient and productive you are the lower the price becomes. Now, if Westinghouse had that problem, they would go broke, too. But presumably they don't.

The question is, what is involved in the concept of effectiveness? Can you elaborate on that and suggest any contribution that we might be able to make in helping to refine the concept of effectiveness as an ingredient in the productivity equation?

Mr. HANES. Certainly, as you point out, effectiveness is most difficult to measure. Efficiency sometimes is difficult, but not nearly as much of a challenge.

I might use an example to try and explain or clarify—and this would relate to a computer center. Users of a computer center have certain needs that they are trying to satisfy. They have certain information and certain data needs that are necessary for them to solve their problems. So if the computer center gives the answers, the information, in a rapid fashion, but it may not really be satisfying the user needs of those using the services, then it really is an inefficient computer operation.

Now, you can keep going up the line, you see. In other words, the organization that is using the services of the computer center doing the right kind of job. You could have an accounting operation as an example that is using a computer, and is the accounting operation doing the kind of work that is most important to the corporation or to the organization, to achieve the overall goals of the organization.

So what one does is keep going up the line, always looking at the higher order organization in terms of the goals of that organization, and how effective is each link in this chain in achieving the overall organizational goals.

I'm not sure if that answers your question.

Mr. BROWN. Yes. That raises a number of other questions.

The concept that you introduce here of each entity being a part of a larger entity is a fascinating one. The question is, which entity do you choose to analyze for effectiveness?

For example, in the Japanese system there were fairly efficient producers of textiles for many years. I imagine there was some trauma involved when they decided to leave the textile business to the less-developed countries such as Korea and Taiwan and go into computers.

Now, the textile people, who may have been extremely efficient within their context, say within a particular factory, may have had a very efficient factory, but let's suggest that their wage rates couldn't compare with the wage rates in Korea.

Now, the question I am trying to get at is this: The productivity of that factory alone would be high, but the productivity of the Japanese economy would be weak because they could substitute imported textiles for the more expensive but very efficiently produced Japanese textiles. The institutional inertia that we have commented on before in many settings would, here, in the United States, lead us to try and protect that textile factory and ignore the overall good of the society.

I know you don't have an answer to this question, but I seek to know if you have given any thought to which level in this more or less infinite series of entities we are to choose to measure effectiveness.

Mr. **Hanes**. It would seem to me that effectiveness should be assessed at every level where it makes sense, each organizational level. Where one can identify that organizational level, one ought to be concerned about the effectiveness of that level. It may well be that the tools, the techniques to assess effectiveness, cut across the various levels. We don't really have the answers now as to how to measure effectiveness very well. We ask people; we perform surveys; we look at the complaints that people make about a given operation, this is a measure of the effectiveness of an operation.

But it would seem to me that if we emphasize research in this area with regard to the measurement of effectiveness, we may well find tools that can cut across many organizational levels.

Mr. **Brown**. Well, you suggested effectiveness is a selection and accomplishment of proper objectives and programs. With this definition applied at different levels of entities you run across the problem that at different levels these entities may be working at cross purposes.

Mr. **Hanes**. Yes.

Mr. **Brown**. In other words, your company may be working in a direction that is contrary to the welfare of the next higher level of organization. for example, the economic system or U.S. society or global society. That raises some very tricky problems when it comes to measuring effectiveness if different entities are moving in opposing directions, motivated by different goals and programs.

In other words, the problem is that of reconciling varying goals and programs. That's a problem we have here in Congress at times.

Thank you, Mr. Chairman.

Mr. **Lundine**. Mr. Walgren.

Mr. **Walgren**. Thank you, Mr. Chairman.

One of the studies you suggest should be made, concerns manpower needs and displacement. Have there been real detailed individual examples of manpower studies?

I remember happenings in Pittsburgh back in the fifties, when the steel mills first began to automate. There was a period of time when there was a great debate about whether automation created unemployment or created more jobs. No one ever gave any answers contributing to the public awareness, or maybe it was the economists who studied the problem. But within the whole area of robotics, are we without any studies as to the anticipated effect or those changes we are about to implement in our workplaces?

Mr. **Hanes**. There are, I believe, some general studies that estimate the manpower implications, but I am not personally aware of any that are very specific, that really have tried to look at a year-by-year basis and make projections. Now, I may be incorrect in this statement.

Mr. **Walgren**. How about within Westinghouse itself? When you go into a foundary or forge and you are about to automate it, you certainly must know the direct implications of change within that factory.

Mr. **Hanes**. Yes. Certainly on an individual basis one can make an assessment of the manpower needs. In the case of the forge shop, the workers there were guaranteed that they would not lose employment beause of the changeover to a robot.

Mr. **Walgren**. Why was that guarantee made?

Mr. **Hanes**. Because the—well, I was involved in the research aspects and I really wasn't involved in the industrial relations considerations. But I would comment that the needs of that particular operation were large; it was an expanding situation, and they obviously had manpower needs that were not being satisfied at that point in time.

Mr. **Walgren**. So they could anticipate more work in the future for that installation?

Mr. **Hanes**. That's correct.

Mr. **Walgren**. In your experience with worker motivation and whatnot, how do you assess the importance of the company being able to insure employment for the worker?

Mr. **Hanes**. Again, this is an area where I think there are some experiences available in the United States and elsewhere, and I really think we need to learn from the experiences of others.

I really don't have an answer to that particular question, other than to suggest that we really do need to have case studies performed and retrospective studies to find out what the implications have been where organizations have gone through these kinds of changes.

Mr. **Walgren**. To your knowledge, has Westinghouse or another company ever done a survey of what impact that factor; namely, the uncertainty of future employment versus some feeling of commitment of the company on the part of the employee has on productivity? Has that been carefully looked at in terms of psychological productivity?

Mr. **Hanes**. I don't know.

Mr. **Walgren**. I suppose there are a lot of ways robotics can go. I was thinking yesterday of the differences between what my distant impression of what the Japanese situation must be like and the employment of pure labor in our society. Much of the white-collar force has a way of interacting with its superiors so that they know they're appreciated. But the pure labor side, the secretarial and the manual, doesn't have those relationships to get a sense of whether or not they are appreciated.

It certainly seems to me it would make a great deal of difference, and I am sure companies must have worked hard on that level of their employee relationships.

Mr. **Hanes**. I would comment that the quality circle program has been received very well by workers within the organization. The number of quality circles is increasing at a very rapid rate. The feedback, both from the workers and management, is quite positive about the worker participation, the worker suggestions, the quality of not only the ideas but also what you might call the improved quality of the workers themselves. They seem to be upgraded because now someone is willing to listen to them.

Mr. WALGREN. I remember someplace somebody said even before the other sins in the Bible were raised by Moses, he noted the sin of being ungrateful. In listening to the Japanese experience, it strikes me that it is true that one of the worst things, in basic human nature, and what we do not want to be, is ungrateful. It strikes me that those workers at General Motors who didn't bother to come to work obviously felt that General Motors hadn't really done that much for them. When expectations rise to the level that the fellow earlier described, when the new workers are assuming that bread and butter will be on the table and are therefore looking for other things, it strikes me that if somehow or other these relationships could be moved to the level of taking advantage of human nature to the maximum degree possible, and if there were some way to express to the American workers, that we could get large increases in commitment flowing back from them. It is almost if the company would commit to them and, in return, they would commit to the company.

Maybe that is far too simple.

Mr. HANES. If I might, I would comment, as in my testimony. There are case studies that I am sure exist where there is this involvement of the worker. The worker is very positive about coming to work. He or she wants to come to work. They don't want to go to the ballgame or go fishing or whatever, go skiiing or whatever else might be available. It seems to me that we need to identify what are the underlying reasons that the workers have that point of view, as opposed to wanting to be involved in recreation or something else. When we get that kind of knowledge, we can package it in guideline form and provide it and disseminate it on a wide basis. That is the kind of information we need to move forward.

But these things don't happen overnight. We have to get research programs in place that will develop this kind of knowledge. So it is not just people's judgment or best guess opinion, but it is based on something more substantive.

Mr. WALGREN. If you happen to run across studies or articles that apply to this, I wish you would send them to me and I will circulate them among the other members.

It strikes me that there is something very basic in human nature that we are not utilizing to full capacity in our system. If we are failing in obtaining from people what we know they have in them, maybe there is a better way to do it.

I appreciate your testimony. I am trying to learn about Westinghouse's involvement in robotics at the Carnegie Mellon Institute. The National Science Foundation has been somewhat involved in that. The National Science Foundation has more than funding problems. It has philosophical problems with the Reagan administration, where they just point blank say that they're not interested in a governmental contribution in the area of human psychology interactions with the workplace. They simply state in their proposals, that those efforts do not justify funding.

Mr. Danforth, the president of Westinghouse, testified I believe at the NSF hearings. I hope that the business community clearly recognized the importance of a governmental effort in that area because they felt we would be able to develop knowledge that would be very useful, but that would not necessarily be developed by the individual companies at this point. And so we certainly appreciate your contribution to the process.

Thank you, Mr. Chairman.

Mr. LUNDINE. Mr. Hanes, I just wanted to ask one followup question out of curiosity that was raised by Mr. Walgren's questioning.

I know you may not have come here as a representative of Westinghouse's quality circle program, but I am interested in what level management is involved and how generally do they go about selecting the management that would be involved in a QC experiment. In other words, I am all for worker participation, but it strikes me that particularly in industry we have a tendency as you pointed out, to have more focus on worker participation. But we are always thinking, myself included, of the production, the hourly worker.

What about the management person at the various levels? Are they involved in the quality circles and how do they disseminate this involvement to their colleagues on the same level?

Mr. HANES. The management, upper management, is strongly supporting the quality circle program. By directives, it has established a quality circle facilitator training project. All divisions of Westinghouse are encouraged to provide people to attend. The facilitator then goes through about a 5-day course to understand how to lead a quality circle.

These typically are either first-line supervisors or sometimes they are people who have been hired especially for that job, or sometimes they come from the work force. These people then go back to their local organization and with the blessing of their local management they set up the program.

The participation is voluntary, and it certainly includes other levels besides the worker on the shop floor. At the R. & D. center we have secretarial quality circles, I believe. I understand that one vice president's staff has formed its own quality circle. These would be all support types of individuals, but they feel it important to use this mechanism. So it cuts across all levels of Westinghouse. I hate to quote numbers. I think I heard someone say that it will be close to 1,000 quality circles by year end—I might be a little off on that number.

The management is required to listen to the recommendations of the quality circle. The quality circle members are trained, in fact, on management presentations, how to present to management, and management has to listen and it has to respond either "Yes, we will adopt these suggested changes" or "No, we will not." But if no, then why not.

Mr. LUNDINE. Thank you very much for your testimony.

We are now pleased to welcome Dr. Otto Larsen, Director of the Division of Social and Economic Science, of the National Science Foundation. Dr. Larsen's field is social psychology. He served as executive officer of the American Sociological Association, and has published widely and taught.

Dr. Larsen, we thank you for your patience this morning. We have your testimony and it will be made a part of the record, and you may proceed as you wish.

[The biographical sketch of Mr. Larsen follows:]

OTTO N. LARSEN

Otto N. Larsen was born January 23, 1922, in Tyler, Minnesota. He received his undergraduate education from Grand View College, Des Moines, Iowa, and the University of Oregon, University of Montana, and Denver University. He received his Ph. D. degree from the University of Washington.

He joined the faculty of the University of Washington in 1951, where since 1962 he has been Professor of Sociology. He has served as Chairman of the Department of Sociology, and Director of the Institute for Sociological Research.

Dr. Larsen is married to the former Greta L. Petersen. They have four children: Paul, 33; Lori, 31; Chris, 24; and John, 22.

Dr. Larsen's field is social psychology where he has specialized in studies of the social effects of mass communication, on the measurement of attitudes and the analysis of opinion formation, and on theoretical work on crowd behavior and social change. Dr. Larsen is the author or co-author of numerous chapters in books, scores of journal articles, and author or editor of six books.

Dr. Larsen was a Fulbright Professor at the University of Copenhagen in 1959–60 and has been a visiting profesor at the University of Colorado, San Diego State University, and the University of Hawaii. He has given invited lectures at the University of Kiel, Lund University, the University of Uppsala, and the Universities of Oslo, Bergen, Milan, and Rome, as well at at many U.S. institution.

Dr. Larsen served as the Executive Officer of the American Sociological Association and editor of several major sociological journals. He has served as consultant to the U.S. Civil Service Commission, the National Endowment for the Humanities, and the Commission on Causes and Prevention of Violence. He was appointed by President Johnson to the Commission of Obscenity and Pornography. He served as Chairman of the Board of Directors of the Social Science Research Council, 1978–1980.

Since August 1980, Dr. Larsen has been Division Director for Social and Economic Science in the National Science Foundation.

STATEMENT OF OTTO N. LARSEN, DIRECTOR, DIVISION OF SOCIAL AND ECONOMIC SCIENCE, NATIONAL SCIENCE FOUNDATION

Mr. **LARSEN**. Thank you very much, Mr. Chairman.

In your reference to my background you omitted one thing. I was the person who worked in the Seattle Parks Department with that lawn mower [laughter] long before Chuck Royer was mayor, incidentally. That's probably why I'm here today.

Mr. **LUNDINE**. That reminds me of my own factory experience. I worked in the factory during the summer while attending college, and somebody asked me if I learned anything that summer. I said, "Yeah, I learned I don't want to work in the factory the rest of my life."

Mr. **LARSEN**. We have a productivity problem.

Mr. **LUNDINE**. Right.

Mr. **LARSEN**. It has been a very exciting morning for me up to this point at least. I have had the privilege to be in this room before when the issue was the legitimacy of social and behavioral science, indeed, its survival. I come here this morning and I hear the room resonate with concepts like attitudes, values, reward structure, organization, profession, information, motivation, cultural influences, power, job mobility, demographic change, organizational flexibility and stability, organizational anthropology, unwritten contracts, alienation, instant gratification, retrospective analysis. It's like being back in the class room or in a seminar.

The session has been a very lively one, and it fits in very well with the point I attempted to make on the opening page of my statement; namely, that I am pleased that this committee has linked the elements of human social factors and technology because I think that is where we are going to have to work to be able to improve productive capacities of our society.

In a way, I am a little wary of proceeding because there is such a good mood about the National Science Foundation here this morning. Congressman Walgren has made the final conclusion that I wanted to hear, and there is a very good understanding of what the Foundation can do, could do, and, to some extent, has done. What better way of demonstrating that than by having people like Dr. Hanes here, and yesterday Professor Maccoby, who have been linked to resources from the Foundation and are doing very important work.

Surely this committee does know of the NSF efforts, how diverse they are. I note in my prepared paper that I discovered—I am relatively new to the Foundation—that there are at least 12 programs in 3 different research directorates that have a concern with human factors in innovation and productivity. Someday all of these various elements within the organization may even begin talking to each other and find that we have greater strength than we had realized.

The NSF approach, of course, as you all are very much aware, is very multifaceted. It involves support for all scientific fields, both disciplinary and multidisciplinary, applied and basic; and it reflects changing scientific interests because the major research agenda is set by the investigators. Of course, these investigators and the Foundation are responsive to the changing national priority.

I don't think I want to dwell very long with the question of the organizational features of the Foundation, other than to say that there is a very lively concern with this and there has been one for over a decade in various places in the Foundation. Each approaches the problem from different directions, and I think that is required.

There are obviously many technical challenges that remain. The most persistent one that I know, that is of interest to me and many of my colleagues, is how do we know that the innovative structures move us toward whatever goals that are outlined. The answer, I think, is that we will not know unless we proceed with the construction of essential measures, doing the basic kind of inquiry that is required.

I include in my paper some testimony from the National Science Board indicating that even the social and behavioral sciences have made significant progress in developing tools, techniques and analytic capability pertinent to this committee's concern.

I also cite in my paper some recent testimony before this committee by one of the national leaders in social science, the president of the Social Science Research Council, who indicates the nature of the social science contribution both in terms of conceptualization and empirical research. He concludes by noting social science itself has been—although it is not often recognized—a source of important social innovation.

In the middle part of my presentation I try to give some samples of the wide range of studies that are supported both in the basic and applied areas. I did not discuss in any detail the intramural research that is also going on in evaluating ongoing programs. The small business innovation or university-Government linkage, also part of the package.

There are studies with an emphasis on innovation; there are studies with emphasis on productivity that are being supported by the Foundation. They cut across a very wide range of concerns. If you look at the examples I presented, each of them has a specific focus. They may not add up to the picture that I posed, into a systematic approach, but that is partly because the Foundation's mode of operating is to respond to the research community and its interests.

I believe there is more weaving together in a broader picture than I perhaps was able to portray with a selection of samples. But you begin to see some of the fundamental concerns in this research. That is, how do innovations get adopted in the first place; how do they get stabilized when they arrive in an organizational context? In the realm of productivity, is it affected by such things as the employee-owned arrangement? How do we look at it historically and what can we learn? What is the effect of unions on productivity? What is the effect of office environments, the administrative services, of workloads? There are many, many different dimensions of the problem; I have referred to in these examples, however, I won't elaborate on them here, except to note that there are also occasionally some surprises that are counterintuitive. For example, when you begin studying not merely the formal record of worker output but also examining what workers are actually doing on the job, you begin to see a different kind of picture of labor productivity.

The work at the University of Michigan suggests that part of the recent decline in the rate of productivity may result from nothing more than measurement error in the measurement of labor hours. Those are fascinating bits and pieces of the research fabric that are being constructed out of support from the Foundation.

What I would like to underscore in this brief oral presentation is not so much the satisfaction with what has been found but the challenges for the future. Some of these have already been noted in rather specific contexts by excellent testimony you have heard thus far.

It seems to me, as I look over the picture from the Foundation's perspective, that we can see that things are moving. There are improved ways emerging to analyze the consequences of different organizational design; there are new tools being devised to determine such things as the optimum level of investment in research and development; and there are national data resources being developed to give better estimates of the linkages among human factors, technological change, and economic growth.

But I would underscore a series of questions I have developed in conversations with my colleagues at the Foundation, things that remain yet to be done. I would consider this merely a small addition to the large research agenda that I have heard in the testimony thus far before this committee and that I welcome.

Among the things that seem to be emerging as research issues, many of which you have had specific examples of, are these: the interaction between the social or managerial innovation, things like quality circles and so forth, and technological innovation are not well understood. How and what organizational innovations promote or enhance adoption and implementation of technology? To what extent do technological innovations require organizational innovation to achieve full implementation? That is clearly a large area of ongoing concern.

The innovation process itself, particularly in small firms, is not well understood. It is unclear how replicable or how transferable the social and organizational aspects of innovation are. It seems to me we have heard a lot about that here this morning, with constant reference to the Japanese case. I would like to add an observation. Before I came to the Foundation, I was working with Japanese social scientists concerned about the concept of information and society. Several communities in Japan that are totally wired with interactive television, computer linkages and so forth. The Japanese are coming to American social scientists because they are concerned as to what this kind of arrangement is going to do to conventional and traditional family and other value structures. They are not above approaching their colleagues around the world to say, "What in the tool kit of social sciences will help us understand value shifts that can come from that kind of introduction of technology of a very high order?"

So when we hear about Japanese productivity advances and so on, let me assure you that their researchers are very much concerned about the impact of even further advances in technology that they have introduced into their culture.

I note also, in the research agenda, that the process by which innovations are implemented and put into operation, as opposed to merely adopted, is not well understood. We have had several instances in the testimony that I have heard that suggest the difficulty, the resistance to change, and the subtle factors that must be involved there.

There has been relatively little careful empirical study on the problem of capital formation. We have had reference elsewhere—and I refer here again to the problem that we have in our ambiguities of concepts and measurements concerning productivity, as well as innovation.

We need to know more about the rates of return from different types of research and development. There are a lot of interconnected, unsolved questions here. How should R. & D. expenditures be measured? Aggregate measures of R. & D. misshifts in the nature of research. One of the explanations for the productivity slowdown may be the shift in R. & D. expenditures away from cost-reducing research to research directed at meeting the requirements of Government regulations.

What affect does inflation have on R. & D. expenditures? The usual deflators for inflation, such as the Consumer Price Index, do not capture changes in the cost of research. How do technological advances affect the economy? Aggregate studies of the U.S. economy estimate that at least one-half of the U.S. economic growth is due to technological change. Research has also shown that the fastest growing sector of the economy is related to information produced by technological advance. But existing theory, data, and estimation methods do not yet permit definitive knowledge of the contribution of different types of private and public research to the economy.

This is especially true for basic research, where the benefits are indirect and the lags between research and the realization of the benefits are long and always uncertain.

Now, there are other items that I have posted concerning social and interpersonal elements in the workplace. We have had reference to that—the importance of attitudes, satisfactions and things of that sort—here in testimony today. I also note that with major innovations come the opportunities where some people will gain and others will lose. This can have a great deal of impact. We don't know enough about the differential consequences of major innovations. It is clearly not an all-or-none thing. And particularly we don't know enough about the impact on communities and regions as well as on individual persons. We need to know more about the impacts and discontinuities of growth and change to prepare the way for possible further innovation.

I note also that social institutions and complex organizations have a role in stimulating or impeding technological change—that's clearly apparent. But understanding the particular effects of strategies of regulation/deregulation, or of organizational size, or complexity in bureaucratic procedures remains an important research challenge. We have had rather specific testimony I think to that in this committee already.

The Foundation, of course, responds to all kinds of things, including suggestions and impulses from this committee. It did in 1979 when at your suggestion in the National Science Foundation Authorization Report, your committee encouraged development of a research program in comparative risk analysis. The Foundation responded by establishing a research program on comparative risk analysis, that I think is going to have more importance in the future than it has had perhaps even in the immediate past. The program, called technology assessment and risk analysis, supports research on the adequacy of data for estimating risks associated with technological innovation, how issues of equity and distribution are considered, deciding whether or not to proceed with innovation, and how decisionmakers make choices under conditions of imperfect and incomplete information, which is the status that all of us are often in.

I would like to conclude by drawing out two conclusions from my rather hasty overview of the rather large efforts of the Foundation in many sectors.

First, I would note that a major part of the uncertainty about the future of economic growth of the United States seems to be due to our inadequate understanding of the processes that determine the rate of investment, whether private or public, in knowledge production, the productivity of investments in this, and how such knowledge gets utilized in the process of technological change. Knowledge has the properties of a public good, but it is also produced privately. I think we need better measures and more usable models to encourage and reflect the involvement of both sectors in the production and use of knowledge.

And finally, Mr. Chairman, I would assert my own judgment that technology policies should not be divorced from economic and social policies and the research on human factors that undergirds our understanding of their very important interaction.

With that brief overview, I would be glad to respond to your questions.

[The prepared statement of Mr. Larsen follows:]

Statement of

DR. OTTO N. LARSEN
Director, Division of Social and Economic Science,
National Science Foundation
before the
Science, Research and Technology Subcommittee
of the House Committee on Science and Technology,
U.S. House of Representatives

September 10, 1981

Mr. Chairman and Members of the Subcommittee:

I am pleased to have this opportunity to describe research on human factors affecting innovation and productivity and to comment on the role of the National Science Foundation.

For social and behavioral scientists, the theme of these hearings itself represents a welcome innovation. Your theme implies recognition that innovation and productivity issues are not only technical or engineering but also behavioral and organizational, and that it is the linkage among these elements that needs to be better understood if we are to improve the productive capabilities of our society.

Mr. Chairman, for more than a decade the Foundation has recognized the urgency of this issue. A variety of programs across several research directorates have a focus on innovation and productivity. In his statement before the Committee on Science and Technology on January 28, 1981, Dr. Donald N. Langenberg, then Acting Director of the Foundation, expressed concern with the pace of technological innovation. He emphasized efforts in engineering, computer sciences, mathematics, and the physical sciences to deal with that concern. He also gave an account of efforts to link researchers in industry and in academic institutions through the Industry-University Cooperative Research Program and observed the special features of the Small Business Innovation Research Program. Today, I will not cover that important ground again, except to note here that significant intramural studies are underway to assess the impact of these NSF programs and to analyze how they are affected by human factors. Instead, I will underscore how the Foundation, from the perspective of the social and behavioral sciences, contributes in fundamental ways to the conceptualization of innovation and productivity, to methodological improvements, and to knowledge gains in this critical area.

Since in research understanding is advanced by questions raised as well as by answers provided, I will also sketch future research needs through a series of questions that flow from our experience.

The NSF Approach

The Foundation's responsibility extends to all scientific fields, involves disciplinary and multidisciplinary research, integrates basic and applied modes, and reflects evolving scientific interests and changing national priorities. Science is a dynamic, pluralistic enterprise; so, too, is its organizational support structure at the Foundation. Nowhere is this better illustrated than in the multi-faceted resources directed to innovation and productivity research.

Currently, there are at least 12 programs in three of NSF's research directorates that bear on the topic of these hearings. Each is vitally concerned with human factors at both the organizational and personal levels. Some focus primarily on problems of productivity, such as the Economics Program in the Directorate for Biological, Behavioral, and Social Sciences (BBS), or the Production Research Program in the Engineering Directorate that is involved with the "Six M's of Manufacturing"--machines, methods, materials, money, men, and management. Other programs emphasize innovation issues such as the Innovation Processes Research Section in the Directorate for Scientific, Technological and International Affairs (STIA). Still other programs assess the combined impact of changes in both innovation and productivity. Examples include the Technology Assessment and Risk Analysis Program, the Socioeconomic Effects of Science and Technology Program (both in STIA), the Information Impact Program and the Sociology Program (both in BBS).

This variety of programs suggests that the Foundation has been innovative in its efforts to address the subject of innovation and productivity. We seek to learn even more about the elements and conditions that enhance or inhibit productivity and innovation; about the consequences, intended and unintended, of the introduction of new socio-technical designs; and about alternative means of assessing the benefits, risks, and costs of a range of innovations in the world of work.

Let me hasten to add that many serious technical challenges face social science investigators as they pursue knowledge in this realm. How do we know that innovative structures move us toward specified goals? Clearly, we will not know unless we proceed with the construction of relevant and essential measures for empirical inquiry. That alone is a formidable scientific task. It is precisely here where the Foundation makes one of its most significant contributions. The point was sharply made in an important statement on the social and behavioral sciences adopted by the National Science Board at its 227th meeting, June 17-19, 1981. That statement, in part, reads as follows:

> As in all sciences, NSF's unique role is the enhancement of scientific capability and the development of the tools of inquiry. The Foundation provides the major support for all the social and behavioral sciences where the focus is enhancing the objectivity of the sciences and improving the quality of data collection and analysis. Such support in the last decade has led to significant progress in the development of tools, techniques, and analytic capabilities. . .

In his testimony before this Subcommittee on March 12, 1981, Kenneth Prewitt, President of the Social Science Research Council, emphasized the role of the social and behavioral sciences in innovation and productivity. Among many important points, he noted,

> Conceptualization and empirical research are two of the ways in which social science will address issues of innovation and productivity. In so doing, social science can, for example, help to establish the boundaries within which innovations might reasonably be attempted. . . Moreover, social science can evaluate whether an innovation has, in fact, worked. . .

> . . . These conceptual and measurement skills will now be turned to questions of innovation and productivity; thus, the search for new economic and institutional forms, risk analysis under conditions of uncertainty, the study of decision processes and means of reaching consensus, the investigation of human creativity and competence. Social science, already international in scope, will help import and transform for local consumption those ideas and organizational arrangements which elsewhere have proven their value to economic productivity.
>
> Finally, social science itself will be the source of social innovations. Previous examples include econometric forecasting, demographic projections, input-output matrices, standardized testing, man-machine system design, operant conditioning. Presently, scholars are working on management strategies for complex organizations, on risk analysis, and on optimal sampling design--all areas in which innovations will be forthcoming.

These observations by one of the leaders in U.S. social science capture the importance of the kind of research that the Foundation supports to advance fundamental knowledge through a strategy that centers on initiatives by investigators. This predominant approach by NSF is supplemented in the case of innovation and productivity issues by staff-initiated intramural studies, assessments, and policy reviews. The following is a sampling of NSF-supported studies where human factors, innovation, and productivity connect.

Studies With an Emphasis on Innnovation

- Robert Yin of the Rand Corporation investigated how innovations are stabilized or routinized in an organization. The long-term survival of an innovation is unlikely unless it is incorporated into organizational rules and manuals, budget cycles, and unless it survives equipment turnover, etc. Innovation, thus is not a simple yes-no decision, but a complex longitudinal process that demands continuous organizational adjustments.

- How do local jurisdictions decide to adopt complex, new technologies? Martha Hollis and associates at the University of California, Irvine have looked at the process of adoption in a variety of municipalities considering the implementation of Fiscal Impact Budgeting Systems using computer models to forecast growth in local economies. The models are more likely to be permanently adopted when local governments are characterized by relative certainty over the course of urban growth and development.

- Richard Kolodny and Bertrand Horowitz of the University of Maryland studied how firm-level decisionmaking concerning R&D is affected by changes in Federal policy. They found that increases in government-mandated reporting requirements tended to suppress the level of R&D actually performed in small firms which, in turn, slows the pace of technological development.

- Research leads to innovation and is subject to innovation. Martin Weitzman of M.I.T. is developing a rigorous theoretical model of research as a sequential information gathering process. The model will produce management tools for making better decisions on the development of technologies. By drawing on information theories and operations research, the approach overcome limitations in conventional cost-benefit analysis.

- A Northwestern University interdisciplinary team of engineers and social scientists, is examining innovations required to integrate sets of neighborhood-scale technologies to meet basic needs for food, water, waste management, shelter and energy in older urban neighborhoods. The research identifies problems and constraints, analyzes alternative strategies, estimates impacts, and clarifies policy options and trade-offs for rebuilding urban neighborhoods.

Studies With an Emphasis on Productivity

- At the National Bureau of Economic Research, Zvi Griliches is doing a major study on the relationships between technological change and long-term productivity growth. The work focuses on building a detailed data set for a large number of firms on their R&D expenditures, patents, sales, employment, assets and market value and using these data to advance knowledge about productivity, private and social returns to R&D, and the usefulness of patents as a measure of innovation.

- A study by Arnold Tannenbaum of the University of Michigan examines a national sample of employee-owned firms to determine how this relatively unusual form of organization affects worker motivation, productivity, and the pace of technological innovation. Worker-ownership is becoming increasingly more frequent in the U.S. economy and we need to better understand its effects on innovation and productivity.

- Traditional investigations of labor productivity largely rely on aggregate, industry, input-output statistics analyzed by way of a production function. However, studies by Frank Stafford at the University of Michigan of what people actually do when they are at work suggest that part of the recent decline in the rate of productivity increase may result from nothing more than a measurement error in labor hours. Comparisons of time actually spent at the work place in the mid-1970s with similar data for the mid-1960s indicates that actual hours have declined, relative to conventional reports of hours worked, at the rate of approximately one percent per year.

- Research by Paul David and Moses Abramovitz, Stanford University, find that the pace and the character of technological and organizational innovation has changed historically from the nineteenth to the twentieth century and this change has altered the relative productivities of various agents of production. The improvement in the productivity of investments in education, research, and health in the twentieth century relative to investments in more factories or machinery is shown to have major implications for social and economic organization in America.

- Ronald G. Ehrenberg of Cornell University is studying the effects of unions on productivity in public elementary and high schools in New York State. The project is developing a plan for long-term study of the public sector area, including work on the methodology of measuring productivity.

- Michael Brill of the Buffalo Organization for Social and Technological Innovation is studying how the office environment affects job satisfaction and productivity. The findings have important implications for the design of the physical structure that create a balance of conditions that facilitate both privacy and communication.

- How much should an organization spend for a particular administrative service? Research by Charles Kriebel of Carnegie Mellon University tests an operational theory in an industrial organization to provide evidence on productivity improvement through various models of resource allocation.

- Michael Shuster of Syracuse University is assessing union-management cooperation and its impact on organizational effectiveness. Firms with union-management cooperation plans are compared to firms without them to see the effect of such plans on productivity, employment, and grievances. The study also examines how the level of technology in a firm affects success of a union-management cooperation plan.

- Research by Sandra Kirmeyer of Cornell University focuses on the effects of workload on stress experienced by service workers. The proportion of the workforce employed in service occupations is expanding as the population increases and life expectancy lengthens. How hospital emergency room workers, and other service personnel, respond to productivity demands bears on the quality of services provided in both the public and private sectors of the economy.

- A study by Albert Bruno and Tyzoon Tyebjee of the University of Santa Clara on the criteria that venture capitalists use to make investment decisions includes interviews with entrepreneurs denied venture capital funding. Venture capitalists perceive the limited availability of opportunities to be much more of a constraint on investment than the availability of capital. The study suggests how a focus on both economic and non-economic factors (such as decisionmaking practices), can increase understanding of how market imperfections might be remedied.

- Jerome Corsi, University of Denver, and a number of colleagues have completed analysis of data from an experiment in New Mexico to indicate that telephone teleconferencing for appeal hearings in two state agencies, the Department of Human Services, and the Department of Employment Security, increased agency productivity and significantly reduced costs without adversely affecting the hearing process. Based on these findings, efforts are underway at both state and Federal level to implement telephone teleconferencing more broadly in a variety of administrative hearing situations.

Future Research Needs and Directions

Mr. Chairman, this account of research supported by Foundation programs, limited as the sample is and diverse as the empirical efforts are, suggests how researchers are dealing with important dimensions of complex problems. Improved ways are emerging to analyze the consequences of different organizational designs; new tools are being devised to determine the optimum level of investment in R&D; and national data resources are being developed to give better estimates of the linkages among human factors, technological change, and economic growth.

However, as I suggested at the outset, our experience yields more about the nature of the challenges ahead than satisfaction with the knowledge gained thus far. What are some of the things that we need to know more about? Among the important research issues are the following:

- o The interactions between social or managerial innovation (e.g., quality circles, quality of worklife programs, participative management) and technological innovation (e.g., changes in manufacturing technology and processes) are not well understood. How and what organizational innovations promote or enhance adoption and implementation of technology? To what extent do technological innovations require organizational innovation to achieve full implementation?

- o The innovation process in small firms is not well understood. Although such firms are generally more innovative than large firms, the organizational and institutional factors responsible are obscure. This lack of knowledge makes it difficult to design government programs that will be helpful to this important sector of the economy.

- It is unclear how replicable or transferrable are the social and organizational aspects of innovation. For example, what happens to innovative firms that are acquired by or merged with other firms? To what extent can a small business milieu be duplicated or protected in a large corporation? How much is innovation dependent upon a few key individuals?

- The process by which innovations are implemented and put into operation, as opposed to merely adopted, is not well understood. Incomplete implementation or premature discontinuence of an innovation is wasteful of R&D resources.

- There has been relatively little careful empirical study on the problem of capital formation in the United States. Long-range corporate planning is hampered by insufficient information on the forces that shape the future rate and direction of capital formation. Research is needed to assess the effects of taxes, and changes in tax laws, on the supply of savings from different sources, and on the demand for investment of different kinds.

- Our understanding of the dynamics of the apparent recent slow-down in American economic productivity is hampered by ambiguities of concepts and measurement. Advances in systematic empirical analyses will require carefully delimited productivity concepts and valid and reliable measures of productivity change for the economy as a whole and for its constituent parts.

- We need to know more about the rates of return from different types of research and development. There are a number of unresolved questions. How should R&D expenditures be measured? Aggregate measures of R&D miss shifts in the nature of research. One of the explanations for the productivity slowdown may be the shift in R&D expenditures away from cost-reducing research to research directed at meeting the requirements of government regulations. What effect does inflation have on R&D expenditures? The usual deflators for inflation, such as the Consumer Price Index, do not capture changes in the cost of research. How do technological advances affect the economy? Aggregate studies of the U.S. economy estimate that at least one-half of the U.S. economic growth is due to technological change. Research has also shown that the fastest growing sector of the economy is related to information produced by technological advance. But existing theory, data, and estimation methods do not yet permit definitive knowledge of the contribution of different types of private and public research to the economy. This is especially true for basic research where the benefits are indirect and the lags between research and the realization of the benefits are long and uncertain.

- Acceptance of technological change to improve productive efficiency is often hampered by failure to consider fully social and interpersonal elements in the workplace. More sophisticated research is needed on attitudes, morale, satisfaction, employee-employer interactions and conflict resolution under conditions bearing on the adoption of innovations.

- With major innovations come opportunities where some will gain and others will lose. This can affect the value of fixed capital, the skill of workers, and markets of firms. We do not know enough about the differential consequences of major innovations, particularly of their impact on communities and regions. How do interregional shifts in resource availability, industrial bases, and population affect political power, economic advantages, and social cohesion? Research is needed on the impacts and discontinuities of growth and change to prepare the way for possible further innovations.

- That social institutions and complex organizations have a role in stimulating or impeding technological change is clearly apparent. Understanding the particular effects of strategies of regulation and deregulation, or of organizational size, complexity and bureaucratic procedures, however, remains an important research challenge. Work in this area is needed to overcome the uncertainty, confusion, and hesitation associated with developing and adopting novel technologies.

One final note on future research needs and directions involves an earlier connection between the Foundation and this Committee. In the 1979 National Science Foundation Authorization Report, your Committee encouraged the Foundation to develop a research program on comparative risk analysis, an area bound to become increasingly important with the growth of technological innovation. The Foundation responded by establishing a Technology Assessment and Risk Analysis Group in August 1979. It supports research on the adequacy of data for estimating the risks associated with technological innovation; how issues of equity and distribution are considered in deciding whether or not to proceed with innovation; and how decisionmakers make choices under conditions of imperfect and incomplete information.

This final phrase suggests an appropriate point to turn from my presentation to your questions. I do so by asserting two conclusions that I draw from our experience:

(1) A major part of the uncertainty about the future of economic growth of the U.S. is due to our inadequate understanding of the processes that determine the rate of investment, private and public, in knowledge production, the productivity of such investments, and how such knowledge gets utilized in the process of technological change. Knowledge has the properties of a public good but it is also produced privately. We need better measures and more useable models to encourage and reflect the involvement of both sectors in its production and use; and

(2) Technology policies should not be divorced from economic and social policies and the research on human factors that undergirds our understanding of their interaction.

Thank you, Mr. Chairman. I will be pleased to answer any questions that you and the members of the committee may have.

Mr. LUNDINE. Thank you very much.

Reference has already been made several times to the status of your funding for social and economic science. Just for a brief review, what is the comparison between your fiscal year 1981 and 1982 funding?

Mr. LARSEN. Well, I gather some final decisions are in the offing about that, but as to what has been proposed—let's just take my division of social and economic science.

In 1980 we were operating under roughly a $33 million budget. The rescission then came and that brought it down to $24 million. The proposed budget for 1982 is $10.1 million.

Overall in the Federal Government, I think a more interesting figure is that—if you look at basic research and social and behavioral science from the period 1980 to 1982, 3 years—there has been a reduction across all agencies of about 28 percent in constant 1972 dollars. Now, there have been some variations within that, for economics in agriculture and so on, and specialized missions. But within the Foundation for that same period, the reduction for social and behavioral science is even more pronounced, about 65 percent. That also continues, unfortunately, in my view, if you take it in constant dollars, a downward trend for a decade preceding that.

The support for basic research in these areas, as you well know, has never been more than 3 to 5 percent of the entire research budget. We need an increase in this area to be more productive.

Mr. LUNDINE. There is absolutely no sense in preaching to the already converted——

Mr. LARSEN. I know.

Mr. LUNDINE. But I just wanted to begin by getting that on the record.

We are all somewhat a product of our own experience and practical observations. In this area, of course, my own comes from a community labor-management endeavor in Jamestown, N.Y. When we first contacted social scientists or any other kind of consultant that could help us with declining productivity and how we might help local industry to restructure its work organization to improve productivity, every single social scientist that came to our community wanted to start with doing baseline studies. I got so sick and tired of baseline studies that we would dismiss without further consideration anybody who even mentioned it.

You have talked about some empirical research. Quite frankly, I guess partly because of this experience, and because of testimony we had yesterday, I am a little bit concerned. Can the National Science Foundation make grants to interdisciplinary research in this area? Are they able to support organizational anthropology? Is participatory research being supported?

It seems to me that possibly one of the problems here is that people outside of our close-knit circle aren't seeing the relevance of this whole area, partly because we have been so interested in empirical data that we are overlooking the real challenge of implementation. We have had a lot of testimony here that applied research in this area at least has raised more questions requiring basic research than it has even answered.

I know I have asked a lot of questions, but do you share my concerns that perhaps social science has tried to be so much like the natural sciences in this area of work innovation, that we have sort of fumbled the ball in terms of its relevance?

Mr. LARSEN. Well, that is a very serious challenge, and the landscape of social science research is changing. Just as we say, a very pluralistic kind of enterprise, there are all kinds of social scientists.

In your State of New York, at Cornell and up at Syracuse and a lot of other places, there is a full range of social scientists concerned, some more with applications, some with very fundamental research. There's a division of labor in this regard.

I suppose if I wanted to try to breathe a little understanding as to why social scientists are this way, it is because they are constantly fighting a side battle, not only for support but for legitimacy as scientists.

Also, we have just come through a growth period in the universities, which is now coming to something of a halt. So most social scientists are located in universities. What you have just described is the detachment of university people generally in pursuing their scholarly research. It isn't just restricted to social scientists. That detachment has positive functions as well.

I would call your attention, Mr. Chairman, to the following problem and division of labor. It is very clear that we need to know a lot more, and research is an instrument of doing this. It is also clear to me that we know more than we utilize. There is this gap between knowing and doing. I have often wondered why barbers need haircuts, shoemakers have holes in their shoes, and sociologists can't run an organization worth a damn. [Laughter.]

The only solution that I can come to, or at least one approach, is that we need even more research on that gap; that is, implementation.

Now, we can fly by the seat of our pants, and we do, trial and error, and work it out some way. But how about systematic inquiry on why it is that we get these baseline responses and don't get any implementation, that we don't do better when we know better. I still think research is the answer——

Mr. LUNDINE. Are you funding that, though? I guess that's really my question.

Mr. LARSEN. I think we are. I think the genius of the National Science Foundation—and I would use my total effort to try to protect that—is to let the science community, where the research capabilities are by and large, set the research agenda.

Now, they are not totally insulated and, if you see what is going on today in psychology, anthropology, sociology and so on, there is very great concern with the so-called applied aspect. There is also in the research communities of those disciplines people who know you just cannot sit and do computer models alone. Those do help, but you have to get into the field situation. There is always something new going on in terms of research style and the integration of those.

So, does the producer of knowledge have to apply it? You may be asking too much of the researcher. If we can get from the researcher some very valid knowledge about the costs and consequences of alternative courses of action, it may take another special kind of knowledge to actually implement that.

I think a division of labor model is appropriate. I don't want to beg off from this. Some of my colleagues are working very hard on that. The Foundation itself supports a very wide range, from a little bit of intramural to mostly extramural, mostly basic in terms of investigator-initiated. I think it is beginning to add up to a package of utility.

After all, wouldn't it be true, sir, if we understand something, how it works, it will be useful.

Mr. LUNDINE. In this area I am also interested in not just case studies, but in comparing several experiences that are similar. The reading I have been able to do, for example, will tell you only of a case study of a particular industry that supplied quality circles. What would be interesting is three successes and two failures——

Mr. LARSEN. Right.

Mr. LUNDINE [continuing]. And I find, personally, very little of that kind of research.

Mr. LARSEN. I think Dr. Hanes referred to that. Incidentally, I think a very great research laboratory on this subject matter is the United States. I know of instances that haven't yet been touched. I believe the comparative perspective cross-culturally is very significant——

Mr. LUNDINE. No; I didn't mean cross-culturally. I mean just in a few industries, a few similar experiments in work innovation.

Mr. LARSEN. Case studies are helpful, but, if we're going to get knowledge, we are going to have to make these kinds of comparisons, no question.

Mr. LUNDINE. I probably ought to know this, but just so that I have a better understanding, how is an NSF grant in social and economic sciences awarded? Basically, what is the process?

Mr. LARSEN. Let me tell you, I'm glad I'm as old as I am, I did once have a grant. I don't think I could qualify any more. The criteria are awfully tough. It isn't just the budget. I am very pleased to have learned that this year.

It works like this. You initiate as a researcher, mostly in the university, a proposal. Sometimes you might call up a program manager and ask some informal advice about this, but it is usually unsolicited.

The proposal comes in and is assigned to a program. The program manager then sends it to ad hoc reviewers, a group of competent external experts on various subject areas who are located across the country. They review this in their own place and write critical evaluations. This, incidentally, draws on the tremendous resources across the country. These are voluntary unpaid efforts.

Those reports come back. Then there is a panel for each program. A panel of competent experts consisting of 8 to 10 persons is rotated about every 2 to 3 years, usually. They meet two to three times a year—next year it will have to be cut back for various reasons—basically funding—but they meet and examine each proposal. In the panel they argue it out. They have the benefit of the ad hoc reviews, but they make their own judgments. There is an interaction process. The program officer is there.

This, then, produces a recommendation to the program officer. The program officer, who is a competent professional person, then makes a recommendation to the director of the division. The director of the division reviews it and forwards it on up through the review chain. So it goes through at least about four technical, professional stages of judgment.

It is called the peer review process, and it's tough. We fund normally only about one-third of the proposals that are received, only at about two-thirds of the requested funding level, which will now next year probably go down to about 10 percent of the requested funding level.

Mr. LUNDINE. Are the reviewers almost all academics?

Mr. LARSEN. Yes, probably, but not exclusively.

Mr. LUNDINE. One concern I have, just to take a popular figure—you know, Studs Terkel wouldn't be a part of this process; would he?

Mr. LARSEN. No; probably not.

Mr. LUNDINE. I'm not antiacademic or antiuniversity, but we are analyzing work, and it seems to me that we have a process that eliminates anybody who works from possibly being a part of that.

Mr. LARSEN. You mean blue-collar work?

Mr. LUNDINE. Well, yes, that's the only real work. You know that. [Laughter.]

Mr. LARSEN. Let me put it this way. As we move over into some of the programs that I referred to—risk assessment and so forth, with productivity in the label—they do draw people, panels, from industry. But these are academics who are now moving into industry. After all, this review process does require knowledge of research methodology, research skills, and so forth.

You're quite correct. It is that. And a judgment is made—let me tell you, that doesn't always produce homogeneity. I have attended many panel meetings where panelists have heatedly debated differences in research styles, and value assessments are made.

Mr. LUNDINE. Yesterday we heard about a research project funded in Norway with participation from the Government, academia, and the private sector, both business and labor.

Are there any efforts in funding joint research projects involving Government, academia, labor, and management that you're aware of, whether in NSF or not?

Mr. LARSEN. No. Well, in NSF there is the university-industry linkage, and there is the small business innovation program that begins to partake of that. My knowledge of that, frankly, is limited. But I do know that that is an attempt to be responsive in that direction.

More broadly, I think that Scandinavian innovation, if you want to call it that, hasn't penetrated very far into the American scene, partly because, when industry gets involved, there are proprietary concepts. This is one of the great difficulties.

Mr. LUNDINE. I was wondering about the Westinghouse case, I assume that as a requirement for an NSF grant, the information resulting from that grant received would have to be publicly available——

Mr. LARSEN. That is right. It is disseminated in the scientific and professional literature. There are no classified data; that's correct.

Mr. **Lundine**. One of the fascinating things you may be interested in hearing about in organizing these hearings is that we find American companies look at this whole social, technical design area in much more of a proprietary way than foreign companies. We have had a harder time getting witnesses from American corporations, where we know there are great successes, for the simple reason that they view it as a great advance to their own profitability.

Mr. **Larsen**. Of course. That is part of our culture.

Incidentally, if I may also suggest, a special role for the Foundation—and Dr. Hanes referred to that—is: How do you get the kind of research done that cuts across Westinghouse, General Electric, et cetera, and then publish the results? That's what we mean when we talk about our research is part of the public good, the common good. I don't know how else you're going to get it done in the United States, given this fact that you have just underscored.

Mr. **Lundine**. Yesterday we received a great deal of criticism from GAO of the entire Federal Government's coordination of productivity improvement programs. One suggestion I have is to coordinate Federal efforts better. Moreover, everybody who gets Federal demonstration grants, whether they get them under the Department of Labor or the National Science Foundation, ought to be willing to cooperate in evaluation of the results.

Mr. **Larsen**. I agree. And there are some coordinating linkages between the various Federal agencies. I know that when we deal in, let's say, the demographic area, we know that other Federal agencies and program officers are in tune to that. They do coordinate.

Now, we have taken some steps, since our funds are very scarce, to try to round up information, let's say, for economists, and say "Here's another place," if that door hasn't been closed. This is a constant problem of coordination and dissemination of information so that the researcher knows.

There is one other angle. If you sit on a peer group panel, you will hear a discussion of individual proposals—that one, and that one, and that one. Now, that is the individualistic model. They often say, "Gee, a piece of that one, and a piece of that one, and a piece of that one put together would make a better study than any single one of those." Well, the mode that we follow is to pick the best individual project rather than mold the best aspects of several projects into a new, improved proposal. It's the competition.

I am trying to search for ways, and I think the social science community is going to have to search for ways of putting together the best pieces and, let's say, making a research team, cross-disciplinary as well, without letting the administrative bureaucrat be the judge. There's a very delicate line here. How do you put these people together? But I think we have to have new innovations and funding for research to get the best kind of quality out of collective as well as individual efforts.

The individual efforts I think we do very well right now.

Mr. **Lundine**. Well, certainly the testimony this subcommittee has heard already would tend to encourage that, and I certainly hope you are able to achieve it.

Mr. Rheem, did you have a question or two?

Mr. RHEEM. Yes. And thank you, Dr. Larsen, for your testimony.

I want to explore a little this side of the aisle's support for social and economic sciences.

Have you found in your work with the administration that it utilizes social sciences?

Mr. LARSEN. Yes, despite what one sees in the headlines when you read about the budget priorities. It is very clear that no complex organization, including the U.S. Government, can afford to try to make decisions without reference to data that have to do with demographic, economic, and social trends.

I understand that in the White House there is in place and being advanced a national indicator system which, indeed, briefs the President and his immediate associates, on a fairly regular basis, on the status of demographic, political, economic, and social trends, without reference to advocacy of a particular policy position, but just what are the facts, what's going on. Where are these data bases and data sources? They are located throughout the Federal Government. There is the Census Bureau, et cetera.

Those are nourished by social science research, and also important data bases out in various research centers across the country at the University of Chicago, Michigan, Wisconsin, and elsewhere that could be and ultimately I think will be linked to this kind of thing on the operating level.

But I would say there seems to be kind of a curious paradox here. I see a great deal of reliance in this administration, as in other ones, and, some innovation in this administration in the utilization of fundamental social and behavioral facts and knowledge.

Mr. RHEEM. Have you thought about that paradox in any detail? Do you think the decision made to reduce funding in the social and economic sciences was specifically a philosophical one, or do you think it was a decision that was made lower down in the hierachy, perhaps even in OMB, and not actually in the administration? And is it possible that the administration is not as opposed to social and economic sciences as one might conclude from this budget action?

Mr. LARSEN. You wouldn't call that a loaded question, would you? [Laughter.]

Let me respond by saying I have heard a lot of different speculations, and someday perhaps some historically oriented political scientist will unearth what really did happen, how that pencil slipped or whatever.

I frankly do not know, but it is a matter of considerable concern, of course, to the social science research community. At the National Science Foundation we live with the processes of priority as best we can.

Mr. RHEEM. One last question.

Have you felt any support from this side of the aisle for the social and economic sciences—this particular cut that was made, or perhaps in the floor action on the Winn amendment?

Mr. LARSEN. Well, as a citizen, I follow these political matters very closely. I was very encouraged, indeed, by what happened to the Winn amendment on both sides of the aisle, and the words that were accompanying it. I think it was one of the first times in a long time that social and behavioral science felt a little proud of the political process. Maybe they had something to do with it. I hope those people up there will respond again and not forget that day.

Mr. **Rheem**. Thank you.

Mr. **Lundine**. The quality of our working life is considerably affected by those bells, but I have to ask one more question before I race off to answer it.

You made the comment that we really know more in terms of this entire area of human factors affecting productivity than we are implementing.

Why do you think that is? What could we do to better make the information about well-known work organization experiments available?

Mr. **Larsen**. That is a very important question. I am sure we have to rely on redundant information systems, as difficult as that sometimes seems. We need better coordination. The responsibility also lies with the researchers and attempting to communicate at various levels with various populations. They can write for professional journals in one way. I think there is a new sensitivity to the need of this, and it is being worked on.

We do have capacities now with computerization for the storage and retrieval of knowledge about research in any kind of categories. There are available resources for that. It is a question also of gaining access.

The Foundation, for instance, in supporting the national data bases, attempts to attach access requirements, so it isn't just the property of a given university but of the total discipline of 250 university-type researchers. I see some steps along that direction.

There are associations—I learned through these hearings that Dr. Hanes represents the Human Factors Society. There are some several hundred persons concerned with that. I assume they are concerned about the dissemination of what they know.

I have been studying innovations and their adoption for many years in kind of an interesting way. Let me just say it took over 10 years for farmers in Iowa to adopt seed corn that was very, very productive. The processes of adoption, whether it is a new drug by doctors or seed corn by farmers, or new knowledge by educators, is a very interesting process. There are always leaders and laggards, and there are always early adapters and the total resisters. We need to know more about that process itself. Then I would be able to address your question, I think, more adequately.

Mr. **Lundine**. Thank you very much. This has made a real contribution to these hearings. They will resume tomorrow morning at 9 o'clock.

[Whereupon, at 12:35 p.m., the subcommittee was adjourned.]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

FRIDAY, SEPTEMBER 11, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:10 a.m., in room 2318, Rayburn House Office Building, Hon. Stanley N. Lundine (chairman of the subcommittee) presiding.

Mr. Lundine. The Subcommittee on Science, Research and Technology will come to order, and we will convene this morning for the third session of hearings on "The Human Factor in Innovation and Productivity."

We have had very stimulating testimony and dialog during the first 2 days of hearings and we are looking forward this morning to hearing comparison between Scandinavian, Japanese, and American efforts in the area of productivity and the quality of working life.

I'd first like to ask Berth Jonsson from Volvo to come to the witness table.

Mr. Jonsson is assistant to Pehr Gyllenhammar, president of Volvo, is a member of their corporate development group, a member of the International Council for the Quality of Working Life. He has a great interest in the future as does this committee. He participated in the first national project group to form a Swedish Institute for Studies on the Future.

He has written as well as participated in his company's programs of development of job design.

We are delighted to have you here this morning, Mr. Jonsson, and look forward to your testimony.

[The biographical sketch of Mr. Jonsson follows:]

CURRICULUM VITAE

Name: Berth I Jönsson

Born: 10 September, 1941

Married, two children (born 1970 and 1973)

Address: Jägarvägen 1
S-442 57 KUNGÄLV
Sweden

Telephone: 303-236 57

Member of "The International Council for the Quality of Working Life"

Member of Programme Committee for the European Centre for Work and Society

1971 -

Corporate Planning
AB Volvo

Has participated in building up Volvo´s planning system and present corporate organization structure

Strategic planning and strategic reports

Business environment studies

Policy work in the fields of organization development, socio-technical design and personnel

Actively worked with Volvo´s new concepts concerning production technology and job design incl the building up of the Kalmar Plant and the Virginia Plant

Formulated Volvo´s system of social reporting and employee reports

In relation to this work served as a guest lecturer at a number of universities in Sweden and abroad (see below)

1967-71

Corporate Planning
Skandia Insurance Company Ltd

Building up of Skandia´s planning system and organization structure

Designed the system of business environment studies

Participated in the first national project group to form a Swedish institute for studies of the future

Policy work of organization development and management development

1965-67

Accounting Department (part time)
Allt för Byggnadsfacket AB

Administrative work
Variety of special tasks and projects

1964-67

Studies at the University of Stockholm
Academic degree, Swedish Fil. kand.

Main subjects: Sociology
Political economy
Statistics
Psychology

A.	Special assigments 1968-80
1968	Member of "group of experts" proposing Swedish institute for studies of the future
1975	Member of the "Integration Committee" of project "Europe 2000" conducted by the European Cultural Foundation, Amsterdam
1977	Executive in Residence (3 months) at Centres d´Etudes Industrielles, Geneva
1977	Expert assignment at UN on "Non-financial disclosure for Transnational Companies" (2 reports)
1979	Research associate in Aspen Institute international project "Jobs in the 1980´s"

B. Undertaken many study tours incl Europe, USA, Japan, and Iran

C. Guest lectures at universities and international institutions

University of Uppsala	Sweden
University of Umeå	"
University of Gothenburg	"
University of Linköping	"
IFL	"
University of Washington	Seattle
Principia College	Elsah, Illinois
Bentley College	Waltham, Massachusetts
University of Minnesota	Minneapolis
Drake University	Iowa
Gottlieb-Duttweiler Institut	Zürich
The Ira Memorial Foundation	Tel-Aviv
Salzburg Assembly in New Technologies	
UNIAPAC, Brussels	
Manchester Business School	
Arbetsgivarnas i Finland Centralförbund	
European Business, Paris	
Society of Automotive Engineers, Detroit	
British Institute of Management	
The Industrial Society, London	
British General Works Managers Association	
The Social Science Research Council, London	

D. Papers and articles

The Diffusion of Work Design Changes in Volvo
- Columbia Journal of World Business, Summer 1976

The Application of Social Accounting to Absenteeism and Personnel Turnover
- Accounting, Organizations and Society, 1978

L'Expérience d'Enrichissement des Tâches chez Volvo
- Analyse Financière, 2e trimestre 1979

Corporate Approaches to the Quality of Work Life
- Pesonnel Journal, August 1980

1 The Quality of Working Life - the Volvo Experience

2 Design of Flexible Work Schedules - Volvo in the Swedish context; a Case Related to the Problem of Absenteeism with its Social and Economic Implications

- Proceedings of the Seventh Annual Ira Symposium on Human Engineering and Quality of Work Life, Tel Aviv, 1980

Corporate Strategy for People at Work - the Volvo Experience
- QWL and the 80's, International Conference on the Quality of Working Life, Toronto Canada, 1981

BERTH I. JONSSON

BERTH I. JONSSON, assistant to Pehr Gyllenhammar, President of A.B. Volvo, is a member of Volvo's "corporate development group," a member of "The International Council for the Quality of Working Life," and a member of Programme Committee for the European Centre for Work and Society. His educational background includes studies in sociology, political economy, statistics and psychology at the University of Stockholm. His choice of study areas perhaps indicate an early interest in a humanist approach to the business environment.

Mr. Jonsson has been an integral contributor to the innovative and entrepreneurial climate of Volvo. Mr. Jonsson's special area of interest has been in the development of new concepts concerning production technology and job design, including the building of the Kalmar and Virginia Volvo Plants. Mr. Jonsson is the formulator of Volvo's innovative system of social reporting and employee reports. He has also contributed to policy work in the fields of organization development, socio-technical design and personnel.

Mr. Jonsson is a person with a great interest in the future. He participated in the first national project group to form a Swedish institute for studies of the future. In 1975, he was a member of the "Integration Committee" of Project "Europe 2000" conducted by the European Cultural Foundation in Amsterdam, and in 1979 he was a research associate in the Aspen Institute international project "Jobs in the 1980's."

In an article for Working Life in Sweden (Number 19, September 1980), Mr. Jonsson has traced the two major phases in the development of job design at the Volvo Company: the spontaneous trial period and the socio-technical strategy period.

During the spontaneous trial period, innovative changes were taking place in different Volvo facilities in a rather uncoordinated manner. An important observation Jonsson makes regarding this phase was that all the workers involved in the first re-design efforts had some "deep concern for people and the problem of alienation."

The second phase involved "building on all the experience gained in different plants and on active and explicit support from top management." Jonsson notes that at this time Volvo is in an advanced stage of the socio-technical strategy period which includes "new creative solutions to flexible hardware technology and the dissemination of ideas to Volvo subsidiaries outside of Sweden."

Essential to Mr. Jonsson's thoughts is the concept that more effective job design solutions must be developed in order to increase efficiency. Such solutions involve "investments, the capability and knowledge among the employees combined with a managerial approach that mobilizes the potential of good working ability."

STATEMENT OF BERTH I. JONSSON, VOLVO CO., SWEDEN

Mr. JONSSON. Thank you, Mr. Chairman.

It is a pleasure for me to be here this morning to give you some firsthand information about the developments in the quality of work, life, and productivity at Volvo over the last decade.

Over the last 10 to 20 years the trend in mass production industry has been to develop more sophisticated engineering methods and highly advanced hardware technology. The degree of mechanization has increased as a consequence, and man has become a cog in a big machine.

A highly mechanized assembly line allows a minimum of personal initiatives and thought. People are taught how to use preassigned tools and given a preplanned amount of work to perform, which leaves the degree of freedom of action utterly limited.

The new corporate strategy in the production area and quality of work life area at Volvo started to develop in the early seventies, moves toward the direction of two ends; that is, first, craftsmanship in the labor-intensive part of our production and the assembly area, and toward automation in the capital-intensive part of our production.

We are convinced that there is a great possibility to create more effective job-design solutions the way we have moved for the last 10 years. The base for this development and for this effort is to find new technology and to develop the capability and knowledge among the employees, combined with the managerial approach that mobilizes the potential of good working ability.

Development of job design at Volvo has gone through two major phases. In the midsixties a number of initiatives were taken on a voluntary basis by foremen, supervisors, industrial engineers, employees, and union people. Programs came out spontaneously without much notice. That was going on in different places, disconnected from each other and disconnected from the top management. The motives for change varied from one department to the other.

For instance, high personnel turnover was a problem, and increasing absenteeism. One cannot identify a number of personal initiatives behind these first redesign efforts that came from the shop floor, from manufacture managers, from the union and so forth. All individuals involved had some deep concern for people and the problems of alienation. We even had a situation for most of the labor market related to industry why it was extremely hard to get any Swedish workers at all. So the immigrant population was growing.

At the time of the Kalmar project back in 1971, which was the pioneering project on new technology, there was a demand from top management to take a more holistic approach. In this first project a whole new concept was implemented. The only way to do this was to put together all the accumulated experience from the different plants of the company.

The effect was not only that the Kalmar plant was built but also that it opened up communication between plants and projects in an interdisciplinary way. In some way one can say that the symbolic effect that this first plant project had became the most important result—a whole new and more creative climate within the company was established through this project.

A new strategy started to emerge. Since 1971-72 a number of projects have started and Volvo definitely has left a disconnected trial period. We built on all the experience gained in the different plants on active and explicit support from top management. No company can afford to experiment on this broad scale. It must create a strategy, and decide how to go about implementing it in the most efficient manner.

Hence, the term experiment does not apply to projects during the last 10 years. Today practically all different product groups, all divisions of Volvo have implemented the new concept that we developed in the early seventies. Thus, the new concept includes production of cars, trucks, buses, marine engines, truck cabins, body building, gear boxes, and a variety of components manufacturing.

Before going farther in this area I would like to say a few words about the company since I think it makes some sense in this connection.

Volvo is basically a very sound and viable company. We have not had a loss year since the early thirties. The company today is very diversified; it operates in more than 100 different countries, and has grown to a $10 billion corporation. It is important to give this business-oriented background to fully appreciate the issues that we address here today.

And then a few words about the concept we continue to develop. The new technology for assembly plants includes a carrier system as an alternative to the conventional conveyor line, the assembly line. There are two types of carriers—one is the electrical-driven carrier and the other type is an air cushion platform. Each carrier is independent from the other. This new equipment allows for a variety of designs all depending on the demands of people and the characteristics of the products.

The new concept implies, for instance, more flexibility both from a technical and from a job-design point of view, more responsibility delegated to the people—that is, increased participation—and finally, the option for teamwork wherever feasible.

The other end of technology is toward automation. Volvo has moved very rapidly toward automation in our press shops, body shops, paint shops, component manufacturing, for instance, in gear boxes and in engine production.

Sweden as a country is the most robot-intensive country in the world. That is, robots per capita. And Volvo is probably the most robot-intensive company in Sweden. It is important to know, however, that whenever we are moving toward automation we take a very careful look at the organization of work. The few people remaining in a high-technology workshop are really key people.

Looking toward our experiences and results in the area I would like to refer back to the first plant project—that was the Kalmar plant. Productivity in Kalmar is 20 percent higher than the target set for the plant and sickness, absenteeism is considerably less. Quality on the products is better as compared to our traditional plants.

This trend also holds for all the other projects as well.

It is important to understand, however, that we are not talking about one model for change but a variety of approaches. In an internal study which has been made within Volvo we have shown that the redesign strategies within the company vary with such factors as management style, social relations, demographic structure, and technology of the products.

Consequently there is no standardized model of change which can be used as a normative tool within the company or between companies. Some general conclusions can, however, be drawn.

For instance, we will fail if we try uncritically to copy solutions from one plant to the other or from one department to the other. We will fail if we do not have a deep-rooted understanding among management of the local characteristics, and it's very important that management develop this ability to analyze local characteristics.

We need an active and positive management attitude toward change. This is a prerequisite for a good result. However, when this attitude turns into an endeavor to impose programs, projects, and plans, from above we tend to fail.

Management has to be sensitive to the fact that the change process will sooner or later affect several organizational levels independent of where the change is initiated.

A process-oriented view should be adopted. The important thing is to learn to study consequences to understand, to communicate, and to take risks and new trials.

Change requires freedom of action and time.

An early confidence with employees and union is vitally important for the success of the projects. To insure lasting effects, initiatives for change must come from the line rather than from the staff or from experts, although the staff and the experts have a very vital role to play as support and expertise.

The process by which job design and quality of worklife and productivity issues has developed in Volvo is a pragmatic approach to solve our problems and an appreciation of the potential energy which only man can mobilize.

The solutions are different in different context, but by combining efforts from different fields of interest, experience, and knowledge, the system keeps developing.

I would like to end by quoting the chief executive officer of Volvo, Mr. Pehr G. Gyllenhammar. He has many times written and communicated the following message: "I believe that humanization of work and efficiency can be compatible. Indeed I believe that in today's society they are inseparable."

Thank you.

Mr. LUNDINE. Thank you very much, Mr. Jonsson. Indeed it's appropriate that you should close by quoting your chief executive officer, not only because he's your boss but also because he is probably one of the greatest industrial leaders in the world in terms of enlightening us about the relationship between the quality of working life and the pragmatic objectives of improving performance and profitability.

I have found, incidentally, his book very interesting and informative.

You have companies—one firm or one plant at least in the United States, as well as several in Sweden; is that not correct?

Mr. JONSSON. We don't have a plant yet under operation. We had a project right before the first oil crisis, and that project never was finished.

Mr. LUNDINE. I see. So the Virginia plant is not operational?

Mr. JONSSON. It's not operational. It's an import facility for the import of cars and trucks and buses at the moment.

Mr. LUNDINE. Nevertheless, why do you think that some companies—both in Europe and the United States—seem to accept the concept of sociotechnical strategies while others continue to use more traditional management?

Mr. JONSSON. Well, you will find that the diffusion of these ideas that emerge from the early 1970's have spread to very many companies in Europe—not least to the automotive industry. I can only mention a few, like Volkswagen, Fiat, Renault, Peugeot, but also over here, and I think that one of the driving forces behind these is to find new ways of getting people into industrial work and to increase productivity.

Mr. LUNDINE. Do you think that the values of workers in Sweden are changing? We have heard testimony in these hearings that there are different rewards and different attitudes that American workers are bringing to the job. Is that true in Sweden, too?

Mr. JONSSON. Absolutely, and we have very many surveys that verify this. In fact, we are moving very fast from a situation where the parents of our young people used to come to work for their standard of living or for survival, while the young people are coming with values which are much more toward developing one's self and toward self-fulfillment. And this is a reality that we have to face and have to adapt to.

Mr. LUNDINE. I am very interested in the Kalmar plant. I always kid people that go over to Sweden that it seems like a mecca for people interested in different work design. You have to go to Kalmar.

Can you describe the specifics of how work is organized at that plant, compared to what I guess we would know as a traditional auto assembly plant.

Mr. JONSSON. It's a final assembly plant for cars. It's not a complete automobile plant. It does not have the paint shop and body shop and press shop, for instance.

Well, a few characteristics of the plant:

First of all, the plant is divided into small workshops and the flow of production runs through these workshops, and the work is designed in the way that people take account for a certain portion of the cars, which they have full responsibility to complete. This also means that they have the responsibility for quality of all of what they produce, and if they don't meet the requirements on quality or productivity, it is fed back to them.

In a traditional automobile plant all the material is piled at the workplace, and people feel confined by all the material surrounding them.

In Kalmar we have a central storage for material and it's up to the people in the teams to order material whenever needed.

People also are involved in the hiring of other team members, they have a team leader who is elected by the team. We have also reorganized the work of industrial engineers and foremen so it better meets the requirements of production. Foremen and industrial engineers are hired with the same educational background and they share the responsibility for two teams.

The carrier system means that we are very flexible. We can move the carriers in whatever directions we like, we can change the layout fairly quickly, and it allows people, for instance, to move to some extent at their own pace, because there is a buffer possibility between the teams.

Mr. LUNDINE. Do they control the speed of the assembly line?

Mr. JONSSON. No. The ordinary way is that pace is set by a computer. But whenever they want to speed up or slow down they can control this process.

Mr. LUNDINE. The team itself.

Mr. JONSSON. The team itself. There is a box in each carrier that they can use to maneuver the carriers in whatever direction they want.

Mr. LUNDINE. Now we've read a lot of articles in the United States and even earlier in these hearings we heard some testimony to the effect that Kalmar and other Swedish experiments had really been a failure. You gave in your testimony some indications of increased production, less absenteeism, and improved product quality as I recall. Can you comment at all one, first of all, Volvo's assessment from a business standpoint of the success or failure of Kalmar, and, second, why, if you do believe it's been successful why do you think we keep hearing that it isn't?

Mr. JONSSON. Kalmar is a clear success from a business standpoint with its 20-percent higher productivity, high quality output, etc. The results from Kalmar but also from some 9 or 10 other projects you will find that where we are gaining the most is in what we call the indirect time of production. That is, all the work that has to be done which is not directly on the car.

That means maintenance quality inspection, it means supervision, industrial engineering and so forth. That's where the gain is made. So the whole organization in these new plants are more lean. Because people on the shop floor take more responsibility and they do a better job right at the workplace.

Comparing the different Volvo plants all over the world you will find that the direct work is about the same in all our plants. But it is in terms of indirect hours that we have a difference, and in Kalmar we have gained a minimum of 20-percent higher productivity as compared to our conventional plant in Gothenburg.

What is interesting about this is also that the economy of scale should talk for the conventional plant—because it's much bigger. But economy of scale works the other way around, and primarily because we can keep a very lean organization.

The other question is more tricky. I think it's probably a kind of media effect. As you know in the early 1970's we all heard about the so-called blue-collar blues, boredom at the assembly lines, and so forth.

During this period we released the Kalmar concept. This was in 1972. The contrast between our concept and the traditional assembly line became so strong that something had to be written up. We haven't, from Volvo, had any reason to publicize a lot. But we cannot avoid that others do the writing. That's I think why rumors start to go around.

Our business is not to make publicity out of this. Our business is to produce cars, trucks, tractors, and whatever. I also believe that many people would like to see a failure because they are so emotionally tied with the past.

Mr. LUNDINE. I assume that at the Kalmar plant you have introduced advanced technology, automated the plant to the extent possible?

Mr. JONSSON. Oh, yes, absolutely. Maybe I can also make a comment about the connection between these carrier based plants and robots. Sometimes you read that these plants are robotized because we have carriers. In some countries you define these kinds of carriers as robots, and we don't do that. Robots is a different thing.

Mr. LUNDINE. Carrier is really just another form of assembly line. It's a different form to be sure, but it's really a replacement of the line to carry the vehicle for assembly.

Can you describe the typical set of events that would lead up to the installation of robots in a Volvo plant, and in particular how are the workers involved?

Mr. JONSSON. A typical design for a project like that would be that we have a steering committee of the project, and that steering committee would consist of managers in charge of engineers who are experts in the field, including electronics and the mechanical aspects, but it would also include representatives of the union—both the blue-collar union and white-collar union.

Under that steering committee would be a number of subcommittees—one would deal with the technical aspect and the layout of the plant, one would deal with hiring and training of people who are going to work in the plant, a third one would take a careful look at the job design. In all of these subcommittees we have managers, engineers, and employee representatives.

We also try to get people who are actually going to work in these workshops to be involved as early as possible in the project.

Mr. LUNDINE. Out of curiosity has Volvo used any sociotechnical designs for office workers or professional workers?

Mr. JONSSON. That's a very interesting question, and we are right now heavily involved in doing these kinds of things and I will give you just one example.

Volvo owns an insurance company which is part of the Swedish organization. We give insurance to Volvo owners in Sweden, and this is a fairly large insurance company—it has close to 40 percent of the market share in Sweden—and the growth has been high, and consequently the burden on this insurance company has grown.

We have gone through three different stages of reorganization—all relating to technology but going from a very basic and manual type of system, with lots of hard work and very labor intensive, toward a kind of intermediate step where we started to use some new technology, and now the third step is to go for a completely computerized system where the people work at terminals all day.

We have found by being very sensitive to the needs of that organization and of the people to design the work that it fits people. We've made followup studies all the time of what's going on, and find a much more positive attitude today.

Mr. LUNDINE. I am interested in that because, as paper shufflers we can understand the agony and anxiety about office technology perhaps even better than we can understand the factory. We hear a lot about the paperless office. And while mounds of paper seem to be the terrible burden on me every day I am utterly frightened, just terribly frightened about coming to work and finding no paper. I don't know if I could adjust to that.

I am sure I could learn to use a computer terminal, but it gives me, I guess, some sense of security to see those papers piled up. Did you find that phenomena in the insurance business? In other words, what was the resistance in going to complete computer terminal?

Mr. JONSSON. We haven't done that sophisticated studies of this, but from a very amateurish point of view I can see a certain correlation with the level of hierarchy and the desire for paper.

Mr. LUNDINE. The higher the level of hierarchy the more the resistance to it?

Mr. JONSSON. That's right.

Mr. LUNDINE. I would suspect that that's true.

Mr. JONSSON. To get the comptroller to use the terminal rather than to have a paper in his hand, would be tricky.

Mr. LUNDINE. Fascinating, though. I visited a Ganett newspaper chain office and in a newspaper of all places, they've completely eliminated any use of paper. We were discussing something about Florida politics and he could punch into a computer and find any story that had been over the Ganett wires within the last 30 days.

One other question at the risk of being undiplomatic; I'm giving you an out if you don't want to answer it. Yesterday here we had a lot of discussion among amateurs—that is Congressmen and witnesses who were other than in the American automotive industry—speculating about why we had been so late in recognizing the consumer demand for greater fuel efficiency, smaller cars, and better quality in smaller cars.

You compete with American and other international automotive companies. Do you have an opinion as to why the American automakers were later than any in the world in recognizing that this change was coming?

Mr. JONSSON. Well, it would be a bit superficial for me to say that I know the truth to this, but generally speaking I think you will find that big organizations have the great difficulty to change—whether it's an engineering company or something else. And you will find that the tradition that is carried from generation to generation within an engineering department for instance, is a big burden if you want to change to a completely new concept. And to some extent we experienced this ourselves.

But since we are a much smaller company I think it's easier for us to change.

Mr. LUNDINE. So that the bureaucratic nature of enormous organizations makes it even harder?

Mr. JONSSON. Absolutely. And my own feeling about this is that it takes a great deal of management gut to make a change, and the key person is of course the person on top of the organization. If anyone can make a change that person should be capable of doing so.

Mr. **Lundine**. That leads me to another point of interest to me. We hear a lot about how Sweden passed the laws and forced you to do this. Your testimony would indicate to me that Volvo changed work systems because you thought that you would produce cars more efficiently that way.

Where did the impetus from the standpoint of your company come from? Did it come from external pressure or internal?

Mr. **Jonsson**. I am glad that I got that question because many people live with the myth that we did this because of new legislation and all that. And I guess some companies do in Scandinavia. But in our case we have taken actions long before the laws were implemented. This includes, for instance, changes in our work environment, and even in terms of codetermination we had—just to give you one example—board representatives of our white-collar and blue-collar union 2 years before this was enforced by law.

By the time we took that decision we didn't know if it would become effective as a law. The strategy that we have applied is to gain maneuverability, and to take initiatives to do our own things. And I think it's only that way you can do it—that is, to be ahead of any legislative effort. Because then you have still the freedom to act and take initiatives. If you wait until the reality is already there you're probably less well off.

Mr. **Lundine**. Plus the attitudes of the workers would obviously be different if they thought something was being mandated on you, rather than if they thought——

Mr. **Jonsson**. Oh, absolutely.

Mr. **Lundine**. In the course of these hearings we've heard a good deal about cultural boundaries, and I think quite correctly have been advised that there may be different solutions in different countries. Could you make any observations about the differences between the Swedish work force and the United States and what lessons, therefore, you think we might draw from your experience?

Mr. **Jonsson**. Well, I have gained some experience of different cultures over the years, and I also see plants that we have in other countries in Europe. To make the comparison between the United States and Sweden I think in one way that it has been fairly easy for us to go toward team work for instance, since there has by tradition been a kind of collective effort in our country—it's easy for people to understand that teamwork pays off also for individuals, and I can see one difference there.

Another difference which is quite evident is that money is not the way to reward people in Sweden any longer, because of our tax structure and the solidarity wage policy that our trade union has been successful in implementing. In the United States money is relatively seen more important reward. This means that we cannot buy people the same way as I imagine can be done in this country. Therefore the social environment is becoming extremely important.

We made a study of people who left the company and why out of frustration some left the company. We found that the one single most important factor was interpersonal relations within the team or between the employee and the supervisor. So we put quite some importance to that.

Mr. LUNDINE. I guess I have to ask an American followup to that, and I'll give you the background as to why I am asking. We had a witness, President of Nipon Electric, who said that the Japanese felt that posting a merit certificate on the wall if you had been an exceptional worker was a great reward, a great motivating force. I asked him whether he thought the same thing would work in California and he smiled and said no, he didn't think it would.

That leads me to ask: In an American work organization if money isn't the reward what is the reward? I'm not sure I understand.

Mr. JONSSON. Well, the primary reward, is to get a good social environment. Second comes the work itself.

Mr. LUNDINE. In other words, a place where as a fact, you understood I was talking about factory workers.

Mr. JONSSON. Oh, yes.

Mr. LUNDINE. I understand that your rewards are that you get to drive Volvos on the company and all that kind of thing, but in your opinion the factory worker would evaluate it by asking oneself: Is this the kind of a job that I like to go to, and is this the kind of work I like to engage in?

Mr. JONSSON. Absolutely. The kind of work and the social environment in that work—that is very important.

Can I make one more observation on this since you mentioned Japan? And I have tried to verbalize the differences between Japan, the United States, and Sweden, and I would like to put it this way in terms of the social environment.

In Japan collectivism is part of the character—it's deep rooted. In Sweden it's part of a party ideology. It's collectivism, and individualism exist at the same time. So you have both ends, so to speak. And I see in the United States more interest toward individualism. Now you have the whole scale, and that's one characteristic of the different cultures which I think you have to take into account.

Besides that we have reached a situation in our labor market where most people are working, which makes the whole labor market very heterogeneous. So there are so many different demands on the job itself; 73 percent of Swedish women in their active years belong to the work force today.

Mr. LUNDINE. I really thank you for adding that because it's an absolutely perfect transition to our next two witnesses, and who happen to be from Japan and United States where we are very interested in that.

I would observe that on Wednesday Professor Thorsrud's testimony on this subject was just outstanding. He said don't be concerned about the names you put on your work organization model. It's like a child—it isn't really yours until you give it a name, and in the United States you must give it your own name and consider your own cultural background.

But I would observe that where individualism is more important it doesn't suggest to me that individuals want to be treated like machines any more than—in fact less so—than in a culture where collectivism, as you put it, is accepted and a part of their way of life.

Mr. JONSSON. Yes. I would agree.

Mr. **Lundine**. OK.

Thank you very much for your testimony; it has been utterly fascinating, and it's great to get some observation about the American automotive industry even if we have to get it from Sweden.

Mr. **Jonsson**. Thank you.

[Three papers of Mr. Jonsson follow:]

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THE APPLICATION OF SOCIAL ACCOUNTING TO ABSENTEEISM AND PERSONNEL TURNOVER

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During the second half of the 1960's, and continuing through the 1970's, the Swedish labour market changed substantially. Structural changes in society, a greater concentration of employment in certain densely populated areas, a high level of immigration, increasing labour obsolescence and a higher percentage of women on the labour market were a few of the changes that occurred during this period. In total, the number of working hours expended decreased by 6.5% between 1965 and 1972. Moreover, this fall occurred despite an increase in the domestic population of working age of somewhat less than 100,000 people, a net immigration of approximately 179,000 people and an increase in the proportion of people gainfully employed. The main factors underlying the absolute reduction in the number of working hours expended were a 9-10% decrease in the average working time per week and a 2% increase in the level of absenteeism during the period. In addition, new legislation concerning security of employment resulted in an extension of the period of notice required prior to terminating employment; so, for example, older employees now have up to 6 months notice of termination. Requirements concerning internal language training within companies during paid working time (240 hr) also have implicitly increased company costs for the employment of foreign labour. Furthermore, from 1 January, 1977 employee rights have changed as a result of the new law on "co-determination". The law will be the basis for national and local agreements on how to develop procedures for participative decision making. Now management is obliged "to negotiate on matters which concern the relations between the employer and members of the union".

THE NEED FOR MEASURES OF SOCIAL COSTS

Companies have become increasingly aware of the effects of the increased levels of absenteeism and personnel turnover. Not only has this reinforced the need for measures to limit them but it has also stimulated some interest in estimating their impact on company costs. However, up until now there has been no comprehensive model which describes their total effects, including costs incurred outside as well as inside the company. Yet there is reason to assume that high levels of personnel turnover and absenteeism increase both national and municipal as well as company budgets.

At the company level, information on internal costs resulting from high absenteeism and turnover should influence the priority given to investments concerned with the working environment. Such overall calculations of cost also could provide better information on which to allocate community resources relevant to people in working life. In this way action could be more directly orientated to problem areas.

An overall evaluation of the consequences of absenteeism and turnover could provide better information for discussions on such basic labour market and working environment questions as the following:

1. What are the actual costs of personnel turnover and absenteeism and how are they distributed between companies, the state, municipalities and individuals?
2. How great are the social costs resulting from these two problem areas?
3. What has been the influence of such present

measures for stimulating the labour market as higher expenditures on training and contributions to removal expenses?

4. How has immigration policy influenced personnel turnover and absenteeism and what are the alternative sources of labour?
5. What are the regional variations in the expenses and income resulting from absenteeism and turnover?
6. What direct and indirect production costs are associated with personnel turnover and absenteeism?
7. What alternative recruitment opportunities, technical production solutions and location decisions are available to companies?

THE DEVELOPMENT OF METHODS TO COPE WITH CURRENT PERSONNEL PROBLEMS IN VOLVO

In Volvo, as a consequence of company size and the variations in the products we manufacture, it has become more and more important to set the correct priorities for investments. Moreover, it is now recognized that such priorities for investment must also take into consideration investments in a better physical and mental working environment and to this end we have devoted a great deal of attention to obtaining information which can facilitate decisions with respect to such investments.

Information has been collected which shows that personnel turnover has been highest in the most rapidly expanding production units. Surveys carried out indicate, for instance, that the rapid expansion of the Torslanda plant during the period 1970–1972 resulted in increases in net personnel turnover of between 5% and 8%. On the basis of such findings we should like to use more comprehensive calculating methods to estimate not only the costs incurred as a result of such a level of personnel turnover but also the savings that could be achieved if sufficiently effective preventative measures were adopted. Such alternative calculations could also be used to estimate the size of investments in the working environment that are necessary for producing particular annual expense savings.

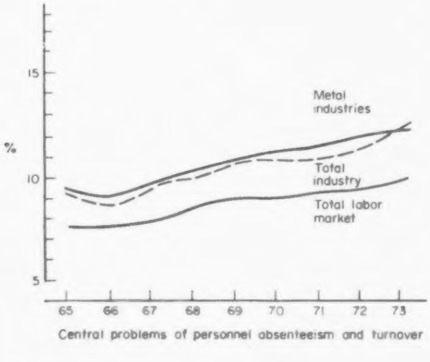

Fig. 1. Absenteeism of blue-collar workers in Sweden.

Already in Volvo we have been able to demonstrate that in most of the production units where improvements in the working environment have been made, reductions in personnel turnover have been achieved. However, corresponding analysis of the measures taken to reduce absenteeism demonstrate that whilst a company influence can indeed be exerted, absenteeism in general is less susceptible to such influences than turnover. Rather absenteeism is more dependent on such factors as the level of financial compensation for absenteeism which is due to sickness – the impact of which is that the employee tends to be completely compensated when he or she is absent. Such calculations point to the fact that the steady increase in absenteeism over the last few years (illustrated in Fig. 1) can be seen as stemming from the political climate to a much greater extent than personnel turnover. However, although a considerable proportion of the factors stimulating absenteeism might rest outside Volvo, the estimates of the financial consequences stemming from them show that the company nonetheless incurs considerable costs.

CENTRAL PROBLEMS OF PERSONNEL ABSENTEEISM AND TURNOVER

Such preliminary calculations provided a basis on which to formulate a number of significant questions related to personnel absenteeism and turnover. Concerning absenteeism, the central problems that were identified were as follows:

1. What are the effects of a continued increase in

absenteeism at the same rate as that prevailing since the mid-1960's?

2. How is it possible to calculate community expenses and community income stemming from a 1% increase in absenteeism?
3. Can present levels of absenteeism within demographic groups be accepted as desirable from a community point of view?
4. Is the increase in absenteeism desirable from the viewpoint of employment and labour market policy?
5. Is the statistical distribution of increased absenteeism among various labour groups desirable?

The problems identified in the personnel turnover area were as follows:

1. What level of personnel turnover can be accepted as desirable from a community point of view? How does this relate to labour market policies concerning factory and office locations?
2. What proportions of personnel turnover are (a) involuntary and (b) voluntary and positive to the individual concerned?
3. Are differences in personnel turnover between different labour market groups to be considered as normal and desirable?
4. How can the expenses and income stemming from a change in personnel turnover be calculated from the point of view of the community economy?

THE DEVELOPMENT OF A SOCIAL ACCOUNTING MODEL

The formulation of such problems stimulated the development of a social accounting model that could provide a preliminary account of certain of the economic and social effects resulting from personnel turnover and absenteeism. It was recognized that the availability of a wider range of information on the economic consequences of the social situation in the company could provide a more comprehensive view of the company's cost structure. Moreover, it was seen as important to consider whether or not current economic methods for formulating investment priorities and making investment decisions needed to be further developed. Hence an attempt was made to find more comprehensive calculating methods which could take into account the overall expense situation, including the incurrence of social expenses within the company.

In developing the model the effects on the state and municipality, the company and the individual were distinguished as is illustrated in Fig. 2. The costs to the company were further divided between those stemming from recruitment, production and resignation, as shown in Fig. 3.

At the company level interest in social accounting focused on the possibility of calculating economic savings that might result from reductions in personnel turnover and absenteeism

State and municipality	Company	Individual
– loss of community production – demand for community capital – private consumption – balance of payment (exports, imports, transfers) – taxes – compensation – moving contribution – unemployment assistance – administration – health care – social benefits – criminal care – welfare	– employment and training costs – surplus employment costs – supplementary cost in production – production losses	– wages – sickness compensation – taxes – housing contribution – other cost changes – work motivation – welfare

Fig. 2. Effects of personnel turnover and absenteeism.

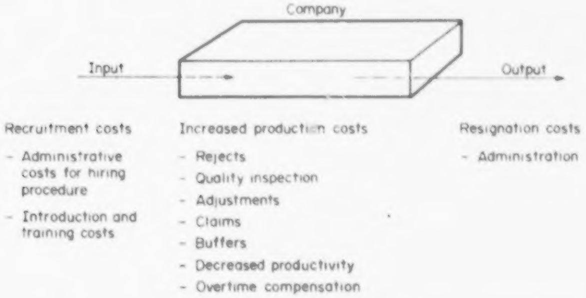

Fig. 3. Model for calculating the company costs of personnel turnover and absenteeism.

and, on this basis, determining investment levels that could be justified on the basis of their favourable influence on social expenses. Such analyses required, however, a great deal of knowledge about the relative effectiveness of managerial actions orientated to such ends. Therefore, in order to build up knowledge of this type whilst also gradually developing new calculative methods, early efforts were devoted to the analysis of actions already taken and the development of alternative approaches to investment strategy formulation and appraisal.

For the analysis of investment in the working environment that had already been made, economic, production and personnel data were used to identify the initial structure of costs and any changes that might have incurred. Whilst there are naturally considerable difficulties in isolating effects and influencing factors and in clarifying causal relationships, such analyses can make an important contribution to our range of knowledge. Even if, from a purely scientific point of view, we must sacrifice dependence on the final conclusions and the possibility of generalization, such analyses can nonetheless contribute to a reduction of our uncertainty over investments of a social or social-technical nature.

Equally it is important to experiment with alternative investment strategies and means for their appraisal. For in many cases where there are problems of absenteeism, turnover, personnel recruitment or monotonous jobs, and where these problems reflect the technical system of the company, the real advantages of change are often not reflected by today's conventional methods of calculation and appraisal. As a consequence, action, if taken, is often of a type which is rather peripheral to the real problem. However, the application of forms of social calculation to problems of this type offers the possibility of broadening the information base for decision-making, thereby possibly changing the decision situation itself. Social calculations at least make it possible to consider ways of making cost savings by reducing such factors as absenteeism, personnel turnover and reject rates. High levels of absenteeism and turnover do result in funds being tied up in unproductive ways and it is certainly valid to inquire into whether or not there are alternative ways of managing which have the potential to reverse such a situation.

Of course calculations of this type must be subject to many uncertainties at this stage in their development. Experience, however, can be and is being gained by monitoring past and ongoing actions, comparing, in the process, the preliminary calculations with ones made in subsequent time periods.

TWO CASES FROM VOLVO'S ENGINE PLANT

The costs involved in such social calculations vary considerably between different types of operations, depending mainly on the skill requirements (and the associated length of on-the-job training) and the structure of manufacturing costs (including the value added in the production process and the costs of tools and equipment). In order to illustrate such cost differences, two cases drawn from the Volvo Skövde Plants will be discussed.

The Skövde Plants manufacture both petrol and diesel engines for the whole range of Volvo products (and through these plants Volvo is nearly self-sufficient in engines). In 1973, 3,456 blue-collar and 707 white-collar workers were employed in the plants and by 1974 the figures were 4,288 and 808 respectively. Average absenteeism was 11.3% in 1973 and 12.8% in 1974, and average personnel turnover, 23.3% in 1973 and 18.6% in 1974.

During 1974 decisions were taken to change the production process in two departments in the Skövde engine plant. One of those departments was a section of the foundry where petrol engine blocks were refined and the other being a department responsible for certain milling cutter operations. Both departments could be characterized as being monotonous work places with high noise levels. Absenteeism and turnover were high.

The cases strive to illustrate how a new investment strategy can serve as a vehicle for more productive developments.

The petrol engine block refinery

The refinery department employed 44 people in total on two shifts prior to any changes in the production process being introduced. In 1973 personnel turnover was 77% and absenteeism 13.3%. Production losses occurred as a result and some engine blocks accordingly had to be refined in another foundry.

In 1974 a decision was made to mechanize the process. The hard, monotonous work was eliminated whilst the more skilled work, including quality inspection and rectification, was left for the people to perform. The first result of the change was a 36% fall in employment in the department due to the mechanization; 28 people were employed after the change, equally divided between two shifts. Thereafter personnel turnover fell to 44%, absenteeism to 8.5% and no production losses were subsequently incurred.

An attitude survey was made after the change, the results of which were consistent with the lower levels of turnover and absenteeism. The employees perceived their status to have increased and the job position and the levels of noise and air pollution to have improved. However, as a result of the mechanization, they reported that stress at work had increased to some extent.

The economic calculation of the gains stemming from lower turnover and absenteeism is shown in Table 1. It can be seen from these calculations that the previous high levels of turnover in particular had resulted in extensive production costs, not least in the areas of quality and production losses. And, in addition to the total gain of Skr.329,100 arising from the reduction in absenteeism and turnover, the direct rationalization of employment resulted in a cost reduction of Skr.850,000.

TABLE 1. Economic calculation of the gains due to lower turnover and absenteeism

	Cost reduction (Skr.)	
	Lower personnel turnover	Lower absenteeism
Recruitment	24,000	–
Training	16,500	–
Overtime	10,300	10,300
Quality	216,000	–
Production losses	26,000	26,000
Total	292,800	36,300

The milling cutter department

This is a small department responsible for the milling of the transmission cover which goes on to the engines. Prior to the changes in the production process, the department suffered from high absenteeism and personnel turnover. In 1973, personnel turnover was 450% and absenteeism was 30% and these together had a number of negative effects on production.

A series of technical and social changes were introduced into the department. Ten people were involved in technical changes, including the introduction of automatic methods of fixing covers to the machines. A job rotation scheme was also introduced between five work stations in order to share responsibility and improve the work itself.

After the changes, in 1974, personnel turnover fell from the 1973 level of 450% to 20% and absenteeism fell from 30% to 8%. Production losses, the rejection of components and quality costs, which had all been high prior to the changes, decreased considerably. One reason for this was

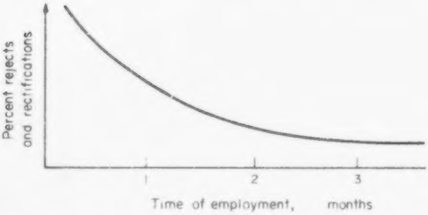

Fig. 4. Relationship between time in employment and rejection rate.

TABLE 2. Social account of benefits from lower absenteeism and turnover

	Cost reduction (Skr.)	
	Lower personnel turnover	Lower absenteeism
Recruitment	40,000	–
Training	27,000	–
Overtime	10,000	35,000
Quality	126,400	20,600
Total	203,400	55,600

that the high initial turnover rate had had a direct effect on such factors since time in employment was negatively correlated with reject rates and rectifications, as is illustrated in Fig. 4.

The attitude survey also supported the hypothesis that work had improved. Positive feedback was received on work position, occupational health and safety, status and relationships with colleagues in the team. However, as in the other case, work stress was perceived to have increased.

The social account of the benefits derived from decreased turnover and absenteeism is shown in Table 2. In addition to the cost reduction of Skr.259,000 stemming from these factors, rationalization due to the technical changes introduced contributed a further cost reduction of Skr.26,000.

TABLE 3. Social accounting of societal consequences

	Summary of decreased demand on financial resources (Skr.)	
	Refinery department	Milling cutter department
STATE		
Decreased sickness pay	15,500	39,000
Increased taxes due to:		
– higher income	345	880
– productivity increase	314,700	95,300
Total	330,545	135,180
MUNICIPALITY		
Increased taxes due to:		
– higher income	580	1,478
– productivity increase	217,900	66,000
Total	218,480	67,478
Total societal effects in terms of reduction of financial resources	549,025	202,658
SAVINGS IN REAL PRODUCTION COSTS		
Lower absenteeism and turnover	329,100	259,000
Rationalization	850,000	26,000
Total	1,179,100	285,000

VOLVO

CORPORATE STRATEGY FOR PEOPLE AT WORK - THE VOLVO EXPERIENCE

by Berth Jönsson

Sweden has long been reknown for its political and labor market stability. For many years Sweden served as the model for an advanced industrial and welfare society. More or less valid stories have been written about this development. The myths have been many and widespread.

During the years when the economy was growing steadily, the political task was easy i.e. to allocate surplus resources among people. Ambitious social programs were implemented. The goal was an egalitarian society based on a welfare system. Rising entitlements were taken for granted. In a time when there is no or very limited excess of resources the task becomes much more difficult and controversial.

During a troubled time like the present it is crucial that industry develops its vitality and keeps enthusiasm going among people. There is a need for new creative solutions in terms of products, technology, management systems and organizational design.

The main focus of this presentation will be on Volvo´s strategy to find new ways to organize work based on the idea that people matter. In fact it is only through stimulated and engaged people that product and market demands can be met.

It is my conviction that philosophies and solutions presented in this case can be transferred to other organizations in other environmental contexts. To start with, a few words about Volvo.

While many Swedish companies are struggling with shrinking market shares Volvo has succeeded to stay competitive and even improve its market position. Volvo is a healthy company with its base in a troubled Swedish economy and in a business faced with major problems. Volvo has not had a loss year since the early 1930´s. Stability and steady growth has characterized the development of the company. Volvo is a large company in the Swedish context.

VOLVO

The impact of Volvo´s operations on the Swedish economy is about twice the magnitude of General Motors´ impact on the US economy.

During the 1970´s the company has succeeded to remain strong in the automotive sectors. At the same time, new business opportunities have been developed, the most important being the energy field. Recently Volvo acquired Beijerinvest, a company which will add new business and new competence to Volvo.

The new group will be a $ 10 billion corporation with 75,000 employees and business in automotive products and components, energy, foodstuffs and trading. The main bulk of the workforce is connected to the manufacturing side of the business. Consequently these people are crucial to the success of the enterprise.

What are some of the distinctive features in the Volvo management philosophy? Among some of the most important aspects I would like to emphasize are:

- pragmatism in finding new solutions to problems and challenges
- business orientation - creativity in new deals and new ventures
- quality in terms of products and service
- innovation both in terms of new technology and organizational concepts; focus on flexibility and the advantage of "small organizations"
- keep a continuous dialogue going with employee representatives concerning business strategy and different policy issues
- counteraction of tendencies toward increased bureaucracy and formality imposed upon the company from outside

VOLVO

The environmental context

General background

Work in the production process is intimately associated with the structure of industry. Over the last few years some of the traditional cornerstones of Swedish economy, i.e. forestry industry, basic metal industries and shipbuilding have all suffered from severe business decline. From a national point of view there is an increased need for other manufacturing industries to compensate for this decline. Among those to fill in one can include the automotive industry.

It's natural in any country for the sector with the largest number of jobs to be given most attention. This has been the case with industry for some decades. The jobs available were mostly to be found in industrial work. It was within the rapidly expanding industrial sector that new jobs were created. Today, merely a quarter of the working population is employed by industry. This fact brings industry into a minority position in the labor market, competing with the public sector which employs around 30 percent of all people.*

A sector of the community that is steadily growing inspires confidence in the future and a relative feeling of security. This has characterized industry up to and including the 1960's. During the 1970's, the drop in the level of industrial employment and structural changes have had a detrimental effect on this feeling of security and optimism concerning the future.

Two of our most important production factors have suffered from intensive cost increases, work and energy. Swedish wages today are among the highest in the world and Sweden is more dependent on import of oil than most other countries.

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* The Swedish Metal Workers' Union (Metallindustriarbetareförbundet) with a membership of more than 400,000 - and for many years the largest trade union in the Swedish Trade Union Confederation (LO) - has now fallen back into second place, The Swedish Municipal Workers' Union now having more members.

Changing labor market

The Swedish labor market has developed in stages towards greater "disharmony" between the supply of and the demand for work. Many factors contribute to this situation, for example, the increasingly heterogeneous composition of the workforce and the fact that we are employing an increasing percentage of different categories of people than most other countries. In other words we are to a very great extent utilizing the "marginal groups" of the labor market.

It is by no means surprising to note that many people under such conditions cannot cope with or are not suitable for the jobs that are available. We are undermining the value of work when we use various measures to force people into work situations that they are unable to cope with either physically or mentally.

I am convinced that this is one of the most important problems we must solve during the next few years. The problem is very extensive and covers labor market policy efforts, values and also the technical and social adaptation of workplaces.

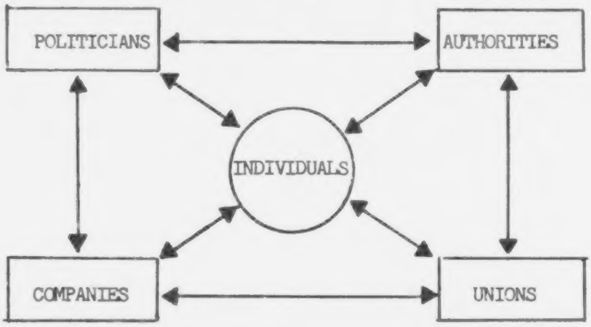
In the future we must create a higher level of consistency between the values and needs of people on one side and labor market measures/job design on the other. Today we use excessively coarse instruments - if we use them at all - in order to describe the needs, experience and knowledge of various groups and to match them against existing and potential jobs. The production of a better description model and the application of this model in practice constitutes a challenge for the future if we are to maintain and develop the meaning and value of work.

Here I should like to briefly discuss the role of work in life. It is not until unemployment turns up that the part and meaning of work becomes clearly apparent. Furthermore, it is by no means usual for people to reject work voluntarily. We do not know of any substitute for work that could cover a greater part of the population. In other words I cannot associate myself with the utopians who consider that we should move away from industrial work by allowing machines to take over and that we should pass our time with activities which are referred to as "of the selfrealization type". On the other hand we have to build industrial organizations which give people a chance to socialize and develop.

A completely different attitude is that work alone does not play a central part in life, many other activities being also highly valued. Work - apart from the fact that it possesses a value in itself - also acts as a fixed point in our existence. Other activities can be structured round this fixed point in both time and space. Furthermore, work provides experience of life, human contacts, and makes its contribution towards personal development. Although far from all jobs possess these characteristics, we cannot cut any corners to attain them.

When unemployment is on the increase, as it is today, the issues tend to be job creation rather than work itself. Rightly it has to be a matter of both employment and work content.

Through the structural and institutional changes in worklife, many decisions and influencing mechanisms have moved out from businesses to the politicians, authorities and parties of the labor market.



How then can companies influence the situation and find new "reward systems". A starting point would be to increase the understanding for the spectrum of need which people have. Which values steer people´s choice in matters of work, workplaces or employers?

Our starting point is that decision-makers, whether they are to be found within politics, interest organizations, public or private sector, have insufficient knowledge about people´s values. Taking for granted that we can improve this knowledge, there remains to build up a creative environment within which we can find new solutions to the concrete problems.

Changing values

We are living and working in a society where people have been used to rising entitlements. The right to receive and the right to consume have not been questioned until now. The effect of reality, however, does not seem to have any strong effect on values. Values do not follow economic fluctuation the way we expected. When industry becomes the "minority citizen" in our society the established acceptance that we have to "produce before we get" starts vanishing.

Due to changing values and lifestyles we can witness today the mismatch which leads to people being available in the labor market but still rejecting the jobs offered.

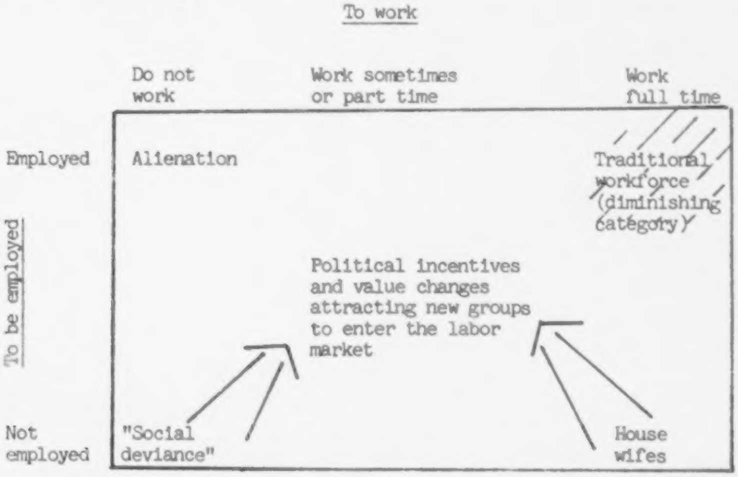
Industrial work in particular has been undervalued during certain periods and has had a very low status. This, in turn, has resulted in the fact that companies have suffered from recruitment problems during times of economic prosperity in spite of the fact that a relatively large amount of labor was available. Not least industry is dependent on the availability of young people.

When the Swedish Opinion Research Institute (SIFO) asked young Swedes (aged 16-24) about their first choice of occupation, 14 percent said "industry". The service sector on the other hand attracted the majority of respondents.

Significant recruiting problems arise in a more and more heterogeneous labor market, not least for industry. There are of course regional differences. The category of people who were once recruited for employment in direct production and who worked on a full time basis has become significantly smaller. To this can be added a lack of skilled labor.

Many companies report growing difficulties to recruit managers who are prepared to "devote" their life to their work. The will to work overtime has also receded. Facing the choice of higher wages or more leisure time, many choose the latter.

Through various labor market policies, new groups of the population have been attracted to seek employment. Political decisions and social reforms lead gradually to a redefining of the labor market, for example, politicians have coined the phrase "employment for everyone" (previously: "full employment"). The greater proportion of the traditional labor force in industry consisted of men who worked full time.


To work
Do not work
Work sometimes or part time
Work full time
Employed
Alienation
Traditional workforce (diminishing category)
To be employed
Political incentives and value changes attracting new groups to enter the labor market
Not employed
"Social deviance"
House wifes

Many new demands, sometimes contradictory, are made on work organization, supervision and, not least, work hours. There is no simple or generally applicable solution to the problem of attracting people to industrial work. Labor market is in a phase of change that is leading to new definitions of work itself.

VOLVO

In order to better understand the environment in which Volvo operates in Sweden, I will briefly elaborate on three topics using some empirical data:

1 Labor force structure

2 Labor market policies and labor acts

3 Work ethics

The changing structure of the workforce

The Swedish workforce has increased in heterogeneity very rapidly in the past 10-15 years. Its pace of change probably has few parallels in the western world.

The structure of human resources in industry also has changed greatly. The potential labor force from which industry once used to recruit the main bulk of its manual workers primarily consisted of Swedish men in their most active years.

This category of people diminished continuously in importance during the 60´s. During the economic boom of 1968/69 the situation became acute.

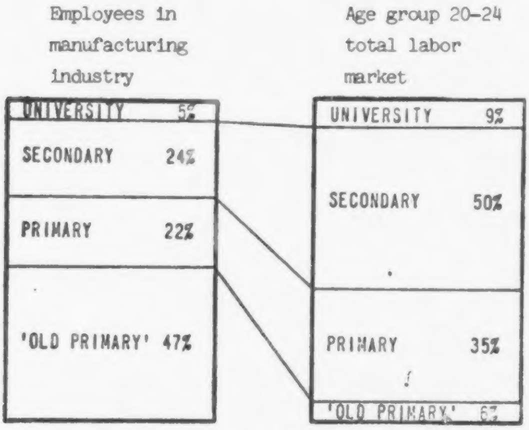
In the latter years of the 1960´s, foreign workers became the primary group to be recruited into industry. In Volvo today for instance about 30 percent of blue-collar workers are non-Swedes.

During the 70´s the largest group entering the labor market was women. In 1980, 73 percent of all women aged 16-64 were in the labor force. The most rapid increase is shown by women with children under seven years of age. This group today equals the average for all female employees.

The total net increase in working population consists of women. 46 percent of women are working part-time compared to 7 percent of all men. This equals 25 percent of the total labor force. The average work-week for a female employee is around 30 hours. The implication is that job-sharing has become a reality.

A third category of people which continues to enter the labor market is the young Swedes with a longer basic education than the earlier generation. Compulsory schooling in Sweden today is nine years. It used to be seven. Very few young people end their education on reaching the compulsory school leaving age. Most continue studies at the level of secondary education or higher.

EDUCATIONAL LEVEL, SWEDEN 1977



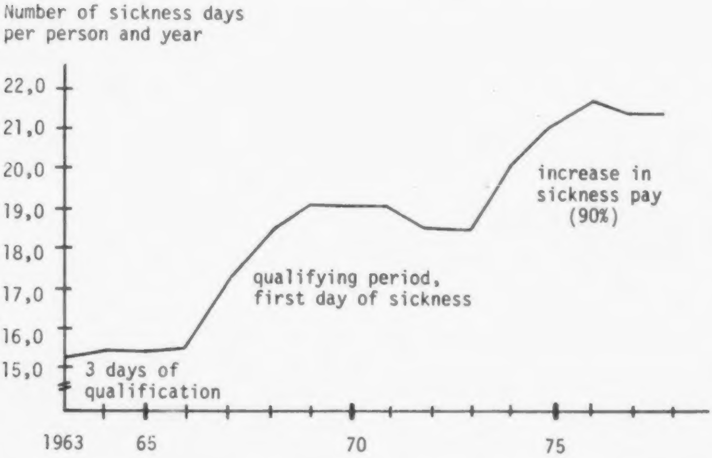
The increased heterogeneity of the work force has caused some problems for industry, for example:

1 Shortage of Swedish labor and a certain resistance, from young Swedes particularly, to go into industry. This tendency dominated in the late 60´s and early 70´s.

2 The labor force turnover rate was on a fluctuating but high level between 1967 and 1974. Personnel turnover has decreased considerably over the last three years and is today around 15 percent or lower on an annual basis. During the late 60´s it was as high as 50 percent for large scale plants in certain regions.

3 Increasing absenteeism and the changing nature of absenteeism on the whole labor market. From 1970 to 1980 the total number of people employed in the Swedish labor market increased by 431,000 (age 16-64). In the period 1970 to 1976 absenteeism increased from 12.6 percent to 15.1 percent (absenteeism measured as percent of working population). Thus in 1976, 132,000 of the increased workforce were merely replacing absent colleagues giving a net addition to the workforce of only 102,000! Stated otherwise, more than every second person who entered the labor market was to compensate for the increase of total absenteeism. Increasing absenteeism consequently means a greater demand for labor.

The national sickness statistics show the following trend:



VOLVO

The absenteeism level in Sweden is very high in international comparisons. Absenteeism today can be viewed as a way to meet needs of people to gain more flexibility in terms of working hours. The "new values" have even been put into our laws.

There are many different interpretations of the complex problem of absenteeism:

Some statements can be made in relation to absenteeism:

- "absenteeism" means much more than sickness. In fact the relative increase in absenteeism is caused by legal rights e.g. child care and study leave
- there is a shortage of Swedish labor. Because of legal rights to stay employed but undertake other duties, e.g. child care, more people, particularly women, have had a chance to enter the labor market
- as a consequence of the variety of absenteeism, its duration and causes, it has become vital for the employer to develop effective manpower planning systems. To match jobs with people´s expectation on work schedule has become a challenge
- the welfare state has accepted an increase in absenteeism including sickness. The upward tendency has even been calculated with in the Swedish Long Term Plan. Reality, however, has often overcome the plan
- Swedish companies keep records of long term sicknesses to a much longer extent than is the case in other countries
- the basic value of security is built into the Swedish system. Absenteeism per se does not threaten the employment situtation. Protection of employment is thoroughly founded. By this follows that registered absenteeism automatically gets high.

New laws and labour agreements

During the 70´s, more than 20 new labor market laws and national collective agreements were introduced. Some of the more important laws cover areas such as:

- board representation of employees
- employment protection
- co-determination
- working environment

The options for different patterns of working life have become numerous. Other laws and agreements have a direct effect on working hours,

- parental leave (maternity/paternity)
- child care leave
- study leave
- language training for foreign employees
- restrictions on overtime
- restrictions of shift-work
- five weeks vacation
- part time pension
- work environment law
- time off for union work
- flexible working hours - local agreements for white-collar employees
- part time work - local agreements (four hours; six hours incl. shift-work)

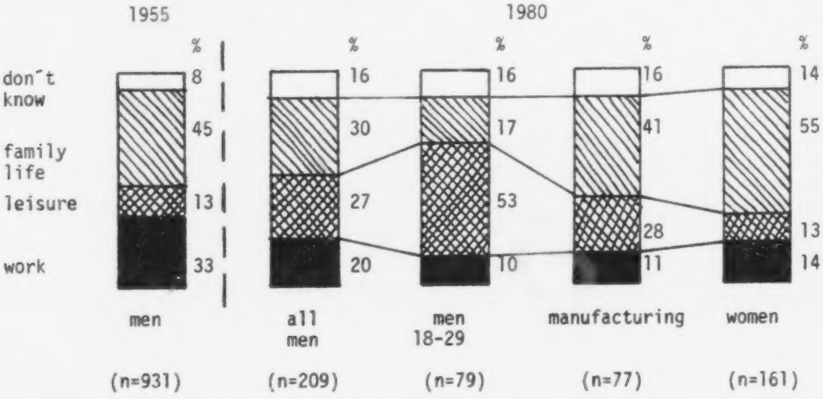
Certain social benefits have had an indirect effect on the availability of working hours.

The changing ethics in regard to work

Naturally, the evolution of an affluent society like Sweden's has also had an impact on ethics concerning work. On the surface it seems paradoxical that more people are working than ever before while opinion research shows that less people find their job as attractive as it once was.

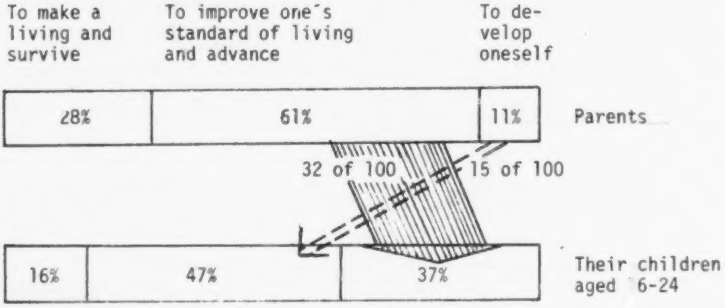
Professor Hans Zetterberg of the Swedish Opinion Research Institute (SIFO) has shown that compared to two decades ago, fewer people today express the view that work gives the greatest meaning to their lives. Work has been traditionally a "lifestyle" for many people. Today there are many other lifestyles competing with work. Work gives the necessary monetary basis for people to undertake other lifestyles. The most important general tendency is different leisure time activities. One would assume that some kind of optimization of time and money would be the goal. The trade-off is evaluated by each individual.

Zetterberg asked a sample of Swedish men, ages 16-74, the following question in 1955: "What gives your life the greatest satisfaction - work, leisure outside family or family life?" This question was repeated in 1980, this time the respondents were both men and women:



Source: Professor Hans Zetterberg, Swedish Opinion Research Institute (SIFO)

Zetterberg has also gone further in describing the generation gap in values. There is clear evidence that we have a "shift from values of production to values of reproduction".* SIFO asked 1055 young people, aged 16-24: "How do you think your parents regarded their work while you were growing up? Did they work just to .... ?" and "How do you yourself regard work? Should a person work just to .....?"



The data show that there is a dramatic change in the values of sustenance and production toward values of self-development.

These changes are fairly dramatic and will undoubtedly lead to different job expectations and call for reforms in life at work.

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* "Values of reproduction" is here used as synonymous to what often is phrased as "quality of life"

Work time patterns

Working hours is and has always been in the focus of Swedish labor market policy. Politicians, unions, employers and the working individual have all had an interest to discuss and negotiate work time.

The European Trade Union Confederation (ETUC) started a discussion after the first oil crise concerning the idea of creating more jobs by cutting working hours. The Swedish trade union (LO) opposed this direction from the very beginning and LO has successfully avoided to mingle the two issues of working hours and unemployment. In reality of course, the different social reforms have had an effect on employment. The difference, however, is that shortening of the work time has a value per se rather than seen as one of the main instruments to cope with unemployment. There are strong groups within the labor movement who are advocating a six-hour workday but with no cut in payment.

Lately, the Swedish debate concerning microelectronics and office automation has been focused on future employment effect. For the first time, a high level union official has proposed a policy of job-sharing to solve possible employment shortages.

The value to decide upon one´s own time allocation has become very strong. This is partly a consequence of new groups in the labor market, particularly women, partly a matter of new values ("the values of reproduction").

In Sweden the new values have been institutionalized in the legislation. This fact calls for more flexibility in terms of working hours. New work time patterns are being developed. People are given new options which include four or six hour workdays (daytime and shift) and weekend work.

The knowledge which people have about their work must be carried over to the other team conducting the same job but at different time. The allocation of responsibility must be thoroughly discussed. The probability is high that by merely working more hours a person gains command of the job and a person working less hours gets off-set. It is a management task to sort out these kinds of issues in participation with employees.

VOLVO

The development of quality of working life at Volvo

When we entered the 1970´s Volvo had had two decades of experience in labor participation within the works councils. This was true for most large and medium sized industries. But it was not until the late 1960´s that the discussions about new forms of participation deepened.

In the early years of this phase the main focus of attention was to increase participation on the lowest operational level in the organization. Terms like job-rotation, job-enrichment and autonomous work groups became common. Few radical changes were made either from an organizational or a technical point of view.

Initiatives were taken on a voluntary basis by supervisors, industrial engineers, union representatives or workers themselves. The need for change often had an ergonomic reason. Job rotation was for instance introduced to ease back pain or similar symptoms in the first hand. Later came concern for social and psychological demands.

In the beginning of the 70´s the issue of board representation began to materialize. But it was not until 1973 that the new law was implemented. Volvo was one of the first companies to invite two representatives of the employees - one white-collar and one blue-collar - to become deputy board members. This was in 1971 and the proposition was to use one year as a trial period. In 1972 it was jointly agreed that the experience was encouraging enough to have the two employees as full board members. This is the real beginning of participation on the corporate and strategic level of the company.

In any organization it is important to gain top-management support for the guarantee of development and survival of new forms or organizing decisionmaking. It is crucial that values of top management are communicated clearly and explicitly. Here I would like to quote Mr Pehr G Gyllenhammar, President and CEO of the Volvo Group:

VOLVO

> "This so-called Swedish model, where employees are beginning to participate in managerial decisions, is more than just an invention due to pressures from labor unions. Sensibly used, I think it is one of the few tools with which to really move an organization in the future.
>
> The presence of members of the workforce does keep one extremely honest, and it keeps them honest too, because all the rhetoric of the bargaining procedure is gone when they sit in the boardroom. They, of course, are at a disadvantage because their basic education is not the same, they don´t know the jargon of the economists and the technicians, but they learn, and they know a lot of other things that the other boardmembers don´t know, and there is a mutual respect. We have had very few conflicts and we have had to make decisions on difficult issues." *

Some of the implications of increased participation for managers are summarized in Mr Gyllenhammar´s own book "People at Work":

- Leadership is crucial, participation actually demands better leadership, as well as more self-discipline, from everyone involved
- It is the weak people in management who have difficulties dealing with employee representatives; until the manager can earn their respect, mutual suspicion blocks an open flow of information
- Leaders who have the strength to give and the strength to talk about their mistakes will earn respect
- To get respect, a manager must be self-confident enough to give respect to the employees as well

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Source: The Business System, The Amos Tuck School, 1977

Below the board level of the parent company the representative system of internal boards can briefly be described as follows:

I. Corporate Works Council

. the company	elects 8 members
. the white-collar union	" 6 "
. the blue-collar union	" 8 "
The working committee has 6 members	(2+2+2)

Its goal is to handle issues on the corporate level related to the co-determination act

II. Supplemented by Works Councils for two Industrial Groups

. Volvo Car Corporation	(4+5+5=14)
. Volvo Commercial Vehicle Corporation	(3+4+4=11)
. Volvo Components Corporation	(4+4+4=12)

III. Representation on Internal and Subsidiary Boards according to Company Law

Representatives of the employees have been involved in all the strategic decisions which have been taken in recent years. These decisions include, for instance, the important step to move into the energy business, overseas investments and acquisitions of other companies. The "Corporate Knowledge" among our employees has grown step by step. They have a clear understanding of the company, our business environment and the demands made on us.

Within the Corporate Works Council, chaired by the CEO, taskforces have been formed at different occasions before strategic decisions were taken.

Formulation of a strategy

> "The modern working man needs a sense of purpose and satisfaction in his daily work. He feels the need of belonging to a team, of being able to feel at home in his surroundings, of being able to identify himself with the goods he produces and - not least - of feeling that he is appreciated for the work he performs.
>
> Factory work must be adapted to people, and not people to machines. This calls for innovation both in the field of human relations and as regards technical aspects.
>
> I believe that humanization of work and efficiency can be compatible. Indeed, I believe that, in today's society, they are inseparable."
>
> (Pehr G. Gyllenhammar)

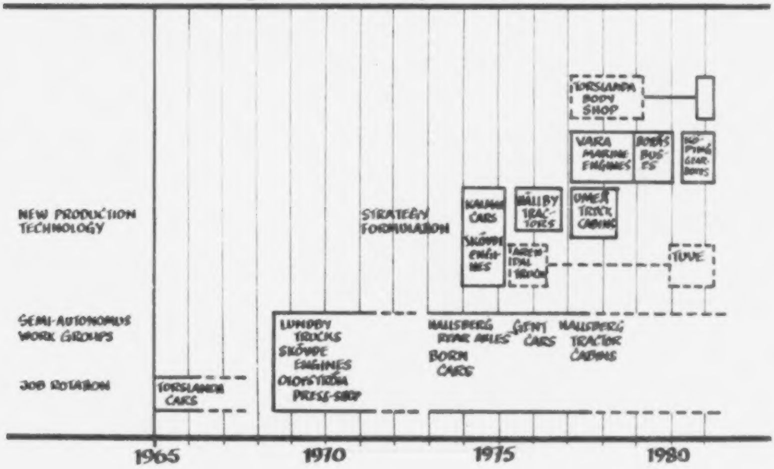
At the time of the Kalmar assembly plant project in 1971 there was a demand from top management to take a more holistic approach. In this project a whole new concept was about to be implemented. The only way to do this, was to put together all the accumulated experience from the different plants. The effect was not only that the Kalmar Plant was built but also that it opened up communication between plants and projects in an interdisciplinary way.

A new strategy started to emerge. Since 1971/72 a number of projects have started and Volvo definitely has left the disconnected trial period. We built on all the experience gained in the different plants and on active and explicit support from top management. No company can afford to continue experimenting on this broad scale. It must create a strategy and decide how to go about implementing it in the most efficient manner. Hence the term experiment cannot apply to projects during the second phase.

VOLVO

We are right now in an advanced stage of the second phase which includes new creative solutions to flexible hardware technology and the diffusion of ideas to other plants. So far there is no product group which has not been effected by the new development. By now change has become institutionalized - with a variety of patterns but with a common ground. Learning and the diffusion of ideas are going on continuously.

Production technology and work organization at Volvo



What demands on strategic Management must be made to successfully establish a long range program on Quality of Working Life? Some of the most important are:

- to communicate values

- to initiate and keep a dialogue going on new issues and new ideas in the organization

- to verbalize a vision

- to work through a conrete idea and establish a visible symbol

- to develop the new culture of openness and learning

- to bring people with different ideas, values and experiences together - directors, management, different groups of specialists, employees

- to gain acceptance for investments which might demand extra capital but will serve as break-through for new ideas

Four myths about Volvo

There are many myths about Volvo´s efforts to introduce new production technology and work organization. The Kalmar Plant particularly has gained a world-wide reputation. The mythology of this plant is spreading and often you hear contradictory messages. There are at least four myths upon which I would like to comment in this presentation:

Myth 1

Kalmar was an experiment which failed!

- This statement is false

In reality Kalmar was the start of a new philosophy, a new strategy of production technology at Volvo. It had the company´s full commitment and was never planned as an experiment. No company can afford to experiment with extensive investments like the Kalmar Plant. The diffusion after Kalmar is also a proof that the new concepts are preferred by Volvo. Seven more plants have been built after Kalmar and two new plants will open in 1981 - all designed in ways influenced strongly by Kalmar.

Myth 2

Kalmar failed because it didn´t meet productivity standards

- This is wrong again

Our experience now is that Kalmar has achieved 20 percent higher productivity than the goals set for the project.

Remember we are in business and we demand return on investments. We continuously must seek new ways of improving productivity. The contrary is not acceptable and unheard of at Volvo.

Myth 3

Kalmar failed because people didn´t like the system of group work, accepting more responsibility etc.

- This is a third, wrong assumption

Our experience is that people are happier with the Kalmar design and work organization than with the traditional one. This is not to say that the organization of work is ideal and that we have reached the only and final solution.

Sickness absenteeism is about half of what it is in our old traditionally designed plant. To sort out another misunderstanding, demanding manual work still has to be done in Kalmar. But if people had a choice, it would be an easy one in favor of the new. Occupational injures have also been cut in half.

Myth 4

Volvo has chosen to focus on restructuring of the labor intensive part of production and thereby neglecting the opportunities of automation.

- Again, this is a completely false perception

Volvo has some of the most technically advanced plants which can be found in the automotive industry including robotization whose pace has accelerated over the last few years.

The first case of realization of a new strategy - the Kalmar Plant

The basic shape of the factory emerged from the idea of production teams. Each assembly team has its own area of the factory where it carries out its part of the assembly operation. The autonomy of the teams has been emphasized through the shape of the building and the supplying of each team with its own personnel facilities. The components inventory that supplies materials to all the teams is located in the center of the building. The teams are spread out along the outer walls of the building. Production began in February 1974. The factory is designed for the assembly of 30,000 cars per year, with one shift of assembly workers. The building is constructed to be able to increase to a second shift.

An important innovation in the new production system is the battery-powered assembly carrier that functions both as a transport device and assembly platform. A central computer keeps track of all the carriers and checks their movement along the production process between work areas. They are controlled through magnetic loops embedded in the floor, but can be manoeuvered manually by means of a control box.

Thanks to this carrier, assembly can be carried out on stationary bodies, which is an extremely important difference from conventional moving-line-fixed-pace assembly. Moreover, the carrier is designed so that it can be easily tilted by 90 degrees when components are being assembled on the underside of the body.

Before and after each work team´s area, there are buffer areas for incoming and outgoing assembly carriers. These buffers make it possible for the team, within certain limits, to work ahead and accumulate time for extra work breaks. The work is arranged so that it takes the same amount of time to carry out the tasks at one work stations as at another. The basis for this balance of task cycles is worked out with the help of method-time-measurement studies, and the task packages at the various stations are normally known as "balances".

The Kalmar Plant has now accumulated seven years of experience and has reached full capacity utilization of one shift. The main results up to now can be summarized in the following points:

- The total assembly times in the Kalmar Plant are less than in a conventional plant. Savings, particularly in indirect time (planning, material handling, quality control etc) are gained at Kalmar. In addition, the Kalmar Plant has some advantages that the conventional factory lacks, though it is somewhat more costly. The extra investment is offset by production advantages, such as a smaller number of supervisors, ease of altering production arrangements. Sickness absenteeism is lower than in most Volvo plants.

- The total effect of these advantages has now become even more marked at full capacity production, and the extra investment cost is completely offset.

- The team organization and the technological production apparatus permits a higher degree of influence by employees on their own work than in a conventional assembly system.

- The design of the factory has provided a good basis for team organization.

- Most workers are very positive toward the team organization, and have a strong feeling of belonging to their team.

- The company has delegated responsibility to the teams to design their own organizations within a certain framework. In a traditional organization, all division of the work is planned at a superior hierarchical level in the line organization. At Kalmar, considerable leeway has been left to the teams to decide the distribution of the work. What happens between the time the incoming materials are received and when completed assembly is dispatched is largely up to the teams to decide. In order to fulfill their assignments, the team members must organize their own work.

The "Kalmar concept" has diffused to a great number of projects. The entrepreneurial spirit that Kalmar created is the driving force behind changes in production technology and organizational design in new and existing plants. A couple of the most innovative projects will briefly be described.

The second pioneering project

For the Volvo Engine Division the late 60´s meant a great deal of rethinking concerning personnel policies and the design of manual work. Experiments like the case previously described became important. Productivity programs through technical changes were implemented. Often resources were mobilized to analyze the needs and undertake changes from a socio-technical point of view.

Two major conditions were fulfilled in Skövde to pursue the program:

1 Resources in terms of management willing to try new organizational concepts and staff who served as catalysts and evaluators

2 Long tradition of joint consultation with the union. Representative system support new development.

A great deal of thinking concerning improved content of work has been focused on extending work-cycles and rotating jobs. To take a more holistic view one has to analyze all possible combinations of tasks to be conducted in view of implications for organizational functional units.

If we believe in shared responsibility for quality we have to review how this will effect the Quality Control function, the line and the workers. What does it mean in terms of less direct authority, need of confidence and new demands on skills and training programs.

It is this vertical integration of jobs which turns out to be important in order to really improve the conditions at work. A vertical integration of jobs demands more time in terms of training but it also challenges given functional and union boundaries. It changes authorities of specialist and line functions as well as makes blue- versus white-collar belongingness less evident.

The E-factory project at Skövde was influenced by the Kalmar project which ran parallel in time but with a different project team. The most common characteristics between the projects are:

- electrical driven trolleys instead of a mechanical driven conveyor-line

- design of group work

- buffers between groups

- extended work cycles through job rotation within teams

Within Volvo Components the new concept has diffused to other projects, the most thoroughly developed case being the marine engine factory in Vara. The plant is a small unit with slightly more than 100 employees divided into two departments, one responsible for certain machine operations and the other for assembly.

The technology used in the assembly workshop is an air-cushion platform. The flow of production is decided upon and controlled by the employees. There are three levels in the organization. Management and the workers have developed common goals covering measures of production, finance, and social realities. The guidelines and targets are under periodical review in joint consultation.

Towards craftsmanship in assembly operations

In the fall of 1974, the Truck Division planned an expansion of its production volume. An initiative was then taken to apply some new ideas of job design in a small workshop. The vision of Kalmar had been assimilated by the people in charge of truck operations even though they had not been engaged in the Kalmar project.

Some managers and engineers met to see if they could apply a system with just one group of people taking full responsibility for the final assembly of trucks. At the same time, a parallel project was underway to construct a plant for assembling tractors, construction and forestry machines.

The two different project groups each developed an air cushion hover platform. Two platforms - one in the front and one in the rear - can easily take a truck or any other heavy product. By using compressed air the truck becomes mobile because of the air pads which keep the platform "floating" just above the floor.

The truck can easily be moved from one assembly bay to the other. Thus the system is extraordinarily flexible and the lay-out within the plant can easily be adapted to the new products and different needs.

The total truck assembly process includes:

- material handling
- pre-assembly of engines and gear-boxes
- " " cabs
- " " other components
- two stations ("bays") for final assembly
- painting and undercoating

During an early phase of this project, 18 operators produced about 500 trucks annually. The work cycle for pre-assemblies and final assembly is around four hours each. At the very least, people know how to perform within one work area. A few people have gained experience amounting to eight hours or more.

Meetings are held whenever needed with the total group of 18 members. In the start-up phase, meetings were quite frequent but lately a meeting every two weeks has been the pattern.

In order to test the new concept 50 percent of the people were recruited externally having no experience with truck manufacturing. Almost all training has been on-the-job. For the four hour work cycle, the learning takes an average of about 60 hours.

The experience from this pilot work-shop for trucks is transferred to the new truck plant being opened in 1982.

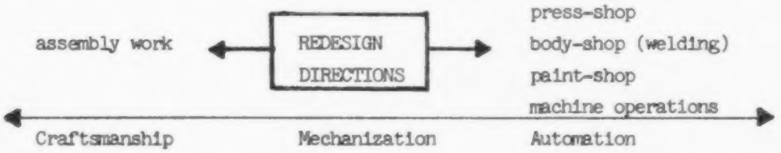
In the case briefly described we can witness a logical loop from the first ideas of Kalmar. The likely future development will be a dynamic one using a set of learning and organizational models. Changes will continue not least in the division of responsibilities between manufacturing personnel, supervision and industrial engineers.

Toward a strategy of job design and learning

Over the last 10 to 20 years the trend in mass production industry has been to develop more sophisticated engineering methods and highly advanced hardware technology. The degree of mechanization has increased as a consequence and man has become a cog in a big machine.

A highly mechanized assembly line allows a minimum of personal initiative and thought. People are taught now to use pre-assigned tools and given a pre-planned amount of work to perform which leaves the degree of freedom of action utterly limited.

In Volvo today, the great majority of jobs is mechanized. At the same time the new corporate strategy is to develop production technology and work organization toward two ends: craftsmanship and automation. During a transition period a number of people will naturally remain in highly mechanized jobs.



The above continuum illustrates the pattern of development at different work-shops. So far very little of traditional assembly work has been able to be automatized.

Since the days of the first volunteer redesign efforts in the 1960's and particularly since the Kalmar Plant (car assembly) and Skövde Plant (petrol engine manufacturing) projects were conducted, the pace of diffusion has steadily increased.

Through internal seminars and documents an exchange of experience is achieved to the benefit of participating groups. Over the last two years the exchange of experience seminars have involved Volvo subsidiaries in Holland and Belgium. The mere fact that two non-Swedish operations participated gives a stimulating dimension to the development of new work structures.

Each plant has found its own feasible pattern of change. Similar to the development in Sweden, changes in both Holland and Belgium comprise the creation of more flexible hardware as well as new ways of organizing work including group work.

In industrial engineering the concept of "work cycles" is quite basic. The time it takes to perform one well-defined task is the work cycle. The work cycle may vary from a few seconds in certain drilling and cutting operations to several minutes in traditional assembly operation. Work cycles in traditional car assembly have been reduced over the last 10 year period to somewhere around 3 minutes. The well-known Lordstown plant of GM became famous partly because of the short work cycles of approximately 30 seconds.

One of the directions at Volvo to reorganize the job has been to extend the work cycles. However, one set of tasks has not been added to another set of tasks randomly. There has to be some logic behind the way to organize the tasks so as to achieve a more meaningful content of work.

One idea which has been implemented at Volvo has been that of combining tasks so that they either lead to the completion of a product, component or a subproduct (complete system or subsystem). To combine a set of tasks to achieve some kind of wholeness has appeared to be a key to improving the work content. By finalizing the product or a subsystem, it is possible for a worker to learn how it functions and consequently it creates the possibility to make quality checks at the spot where the assembly takes place. Any corrective actions can likewise be made at the source of error.

This model has been extended both in a horizontal way (longer work cycles combined in a logical way leading to a sense of completeness) and in a vertical way, i.e. integrating other types of jobs with the original one. Such jobs may include:

- inspection of incoming material
- material handling
- quality inspection of the product
- rectifying of errors
- tooling and re-tooling
- maintenance work on tools and machinery

In several cases at Volvo the logical development of a project has included these two steps - step 1 extended work cycles, step 2 vertical integration adding one or more of the tasks mentioned. A strategy of training has been the natural support system to a successful implementation of projects.

In some cases the learning has gone beyond what has been described so far. In one upholstery department, in some areas of the press-shop, in one truck assembly and in one machine operation (to mention a few) additional responsibilities have been taken over by the operators. This could be labelled step 3.

Such responsibilities include:

- participation in production planning
- " " rationalization projects
- " " hiring procedures
- " " evaluating output
- " " technical development (tools etc)

By using the three step model we will see how learning develops within a work group.

In Volvo there are two more programs which on occasion serve as support systems to the shop-floor work. The first one deals with lectures and discussions about the product as such, its functioning and its characteristics. The second type of program goes into interpersonal relations, group behavior and problem solving.

It should be noted that the total model as outlined above seldom has been completely implemented. However, it shows the possible alternatives available. Based on Volvo experience it could be said that each plant and each department has found a procedure of development which fits its own needs.

A general observation can be drawn from recent development work. The less complex the work is in itself (i.e. a minimum of possible horizontal integration) the more willing and demanding are people to adopt new tasks and responsibilities (vertical job integration). This is true, for instance, in group work on some of the press lines and in a machine workshop (engine block department).

On the other hand, assembly work in itself can be extended to a large extent (e.g. in Kalmar to around 30 minutes and in the truck workshop to 4-8 hours). The possibility of a large horizontal integration seems to lead to a division of tasks. In most assembly groups, for instance material handling, is designated to one particular group member who the group selects itself. Sometimes this special task is rotated among group members each half day or a person may keep it a full week.

What are the driving and restraining forces to successful implementation

As previously mentioned, external and internal forces influence new ways of organizing work.

In a recent study at Volvo it has been shown that re-design strategies within the company vary with such factors as management style, social relations, demographic structure and technology.

Consequently, there is no standardized model of change which can be used as a normative tool within a company or between companies.

Some general conclusions can, however, be drawn from the study:

1 We will fail if we try uncritically to copy solutions from one country to another, from one plant to another within the same country, or even from one department to another within the same plant

2 When management has a deeply rooted understanding of the local characteristics, our chances of success increase

3 An active and positive management attitude toward change is a prerequisite for positive results. However, when this attitude turns into an endeavor to impose programs, projects and plans "from above" we tend to fail

4 Management has to be sensitive to the fact that the change process will sooner or later affect several organizational levels, independent of where the change is initiated

5 A process-oriented view should be adapted; the important thing is to learn, to study consequences, to understand, to communicate and to take risks in new trials. Change requires freedom of action and time

6 Management development with the focus on change and on the dynamics of both the internal and external social system will increase the capacity for change

7 To ensure lasting effects initiatives for change must come from the "line" and not from white-collar specialists

8 The role of the behavioral scientists should be that of the catalyst

9 Foremen and industrial engineers have an increasingly crucial role to play. Through training, organizational changes or participation in joint consultation groups, they have been brought closer to the problems of the shop floor and have acquired a broader awareness of the social requirements related to technical problems

10 Changes in the work situation must include a "package" of activities introduced over a period of time. The "package" would include delegation of responsibilities, integration of jobs where other skills are required, job rotation, participation in decisionmaking concerning the job situation, and changes in physical working conditions. Isolated trials with the introduction of, for instance, simple job rotation, are doomed to failure. To be effective, changes in the work organization must be fully integrated with a system of joint consultation

11 Many changes are undertaken spontaneously without the aid of projects, without scientific sophistication, without their being reported to anybody. These changes occur simply on the initiative of keen and interested individuals.

The process by which job design has developed in Volvo is a pragmatic approach to problem solving and an appreciation of the potential energy which only man can mobilize. The solutions are different in different contexts but by combining inputs from different fields of interest, experience and knowledge the system keeps developing.

19/8/81

VOLVO

DESIGN OF FLEXIBLE WORK SCHEDULES - VOLVO IN THE SWEDISH CONTEXT; A CASE RELATED TO THE PROBLEM OF ABSENTEEISM WITH ITS SOCIAL AND ECONOMIC IMPLICATIONS

by Berth Jönsson

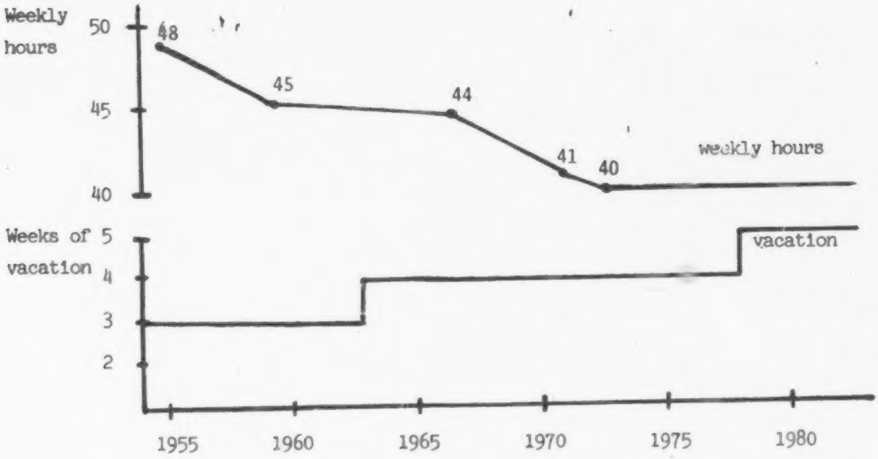
A few years back, the debate in Sweden concerning working hours was dominated by the issue of the six hour working day. The goal for the Swedish Trade Union Confederation (LO) was to achieve the six hour working day with full pay (equal to eight hours) during the 1980´s. It should be stated, however, that LO does not see shortening of the working week as a means of creating new jobs.

When the economy was booming, a reform in this direction was looked upon as being realistic in the near future. In today´s economic situation, the demands are more modest. The reform which was implemented in 1979 gives an option of a six hour working day for parents with small children. Long term, however, the six hour working day is a political issue of importance. In the long range plan for Sweden there is a 30 hour working week forecasted around the year 2000.

To give a better understanding of the Swedish situation, I will briefly describe the changing conditions on the labour market.

Structure of working hours

Sweden follows the pattern of Europe in terms of average working hours. There may, however, be a greater variety of working schedules implemented today than in most industrialized countries. The reason for this is mainly the increased heterogeneity of the labour force. Weekly working hours and vacation time in manufacturing industry have developed according to the following picture:



The accumulated number of working hours in the labour market is continuously decreasing in spite of the fact that there has been an increase in the labour force:

YEAR	LABOUR FORCE (1000s)	MILL WORKING HOURS	WORKING HOURS PER PERSON
1965	3 698	6 665	1 800
1970	3 854	6 486	1 680
1975	4 062	6 350	1 560
1980	4 189	6 284	1 500

Shift work is quite common in European industry. EEC reported in 1975 that one out of five industrial employees was on shift schedules. Shift work is increasing in Sweden but is less common than on the continent of Europe.

The Swedish labour market has been described as one of the more "flexible" in terms of variety of work patterns related to working hours which maily are a function of the changing

1 work force structure
2 legal structure and labour contracts
3 work ethics

VOLVO

1 Changing structure of work force

The Swedish work force has increased in heterogeneity very rapidly in the past 10-15 years. The pace of change probably has few parallels in the western world.

The structure of human resources in industry also has changed greatly. The potential labour force from which industry once used to recruit the main bulk of its manual workers primarily consisted of Swedish men in their most active years.

This category of people diminished continuously in importance during the 60´s. During the economic boom of 1968/69 the situation became acute.

In the latter years of the 1960´s foreign workers became the primary group to be recruited into industry. In Volvo today for instance about 1/3 of blue-collar workers are non-Swedes.

During the 70´s the largest group entering the labour market has been women. Almost the total net increase in working population consists of women. Sweden depends on female labour to a greater extent than most countries. According to OECD statistics* 1975 68% of Swedish women 15-64 years of age were working. This should be compared to Great Britain 55%, France 57% and West Germany 49%. To a great extent, women demand part-time jobs. About 90% of part-time workers are women.

- 1 out of 5 are working part-time -- in industry 1 out of 10
- 9 out of 10 are women
- 4 out of 5 in the annual increase in labour force (1974-77) are part-time workers
- part-time work of less than 20 hours/week is decreasing

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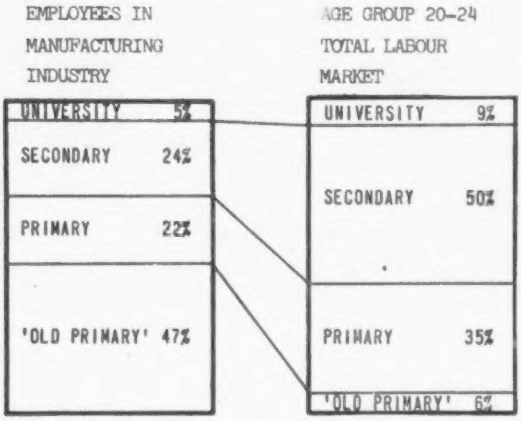
* OECD Manpower and Social Affaires Committee, 1978

PERCENT, BY SEX, OF PART-TIME WORKERS

YEAR	VOLVO MEN	VOLVO WOMEN	VOLVO WEIGHTED AVERAGE	INDUSTRY WEIGHTED AVERAGE
1974	8	38	21	-
1976	9	39	22	9
1978	11	42	25	15

A third category of people which continues to enter the labour market are the young Swedes with a longer basic education than the earlier generation. Compulsory schooling in Sweden today is nine years. It used to be seven. As can be seen from the picture very few young people end their education on reaching the compulsory school leaving age. Most continue studies at the level of secondary education or higher.

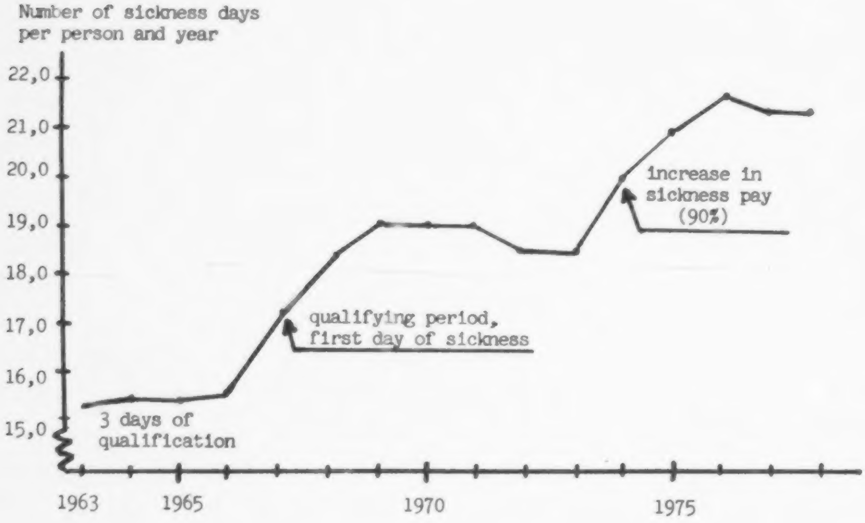
EDUCATIONAL LEVEL, SWEDEN 1977



The increased heterogeneity of the work force has caused some problems for industry including supply of working hours per employee.

We are faced with increasing absenteeism and the changing nature of absenteeism on the whole labour market. From 1970-1976 the total number of people employed in the Swedish labour market increased by 234,000. In the same period absenteeism increased from 12.6% to 15.1% (absenteeism measured as percent of working population). Thus in 1976, 132,000 of the increased workforce were merely replacing absent colleagues giving a net addition to the workforce of only 102,000! Stated otherwise, more than every second person who is entering the labour market has been to compensate for the increase of total absenteeism. Increasing absenteeism consequently means a greater demand for labour.

The upward trend in sickness absenteeism according to the National Insurance Agency is illustrated below:



Before 1967 it took three days until an employee was qualified to receive sickness pay. Since that year, one gets paid the day after having fallen ill. In 1974 the amount was increased to 90% of wage received, and also became taxable.

2 New laws and labour agreements

Over the last few years a number of new labour market laws and agreements have been introduced. Many of these have had a restraining impact on the supply of working hours.

The most important laws and agreements which have a direct effect on working hours are listed in the following picture:

- parental leave (maternity/paternity)
- child care leave
- study leave
- language training for foreign employees
- restrictions on overtime
- restrictions of shift-work
- 5 weeks of vacation
- part time pension
- work environment law
- time for union work
- flexible working hours - local agreements for white-collar employees
- part time work - local agreements (4 hours; 6 hours incl shift-work)

Certain social benefits have had an indirect effect on the availability of working hours. The greatest impact has come from the reforms in the sickness-insurance system.

3 Changing ethics in regard to work

Naturally, the evolution of an affluent society like Sweden´s has also had an impact on ethics concerning work. On the surface it seems paradoxical that more people are working than ever before while opinion research shows that less people find their job as attractive as it once was.

Professor Hans Zetterberg of the Swedish Opinion Research Institute (SIFO) has shown that compared to two decades ago, fewer people today express the view that work gives the greatest meaning to their lives compared to two decades ago. Work has been traditionally a "lifestyle" for many people. Today there are many other "lifestyles" competing with work. Work gives the necessary monetary base for people to undertake other lifestyles. The most important general tendency is different leisure time activities. One would assume that some kind of optimization of time and money would be the goal.

Alternative working hours

Against this rather complex labour market background, Mr Pehr G Gyllenhammar, President of AB Volvo, proposed in 1976 a "contract" which would allow the employee to choose his or her pattern of working hours.

In 1976, Sweden faced a severe downturn in its economy which was not perceived by many people then but which today has become a reality to everyone. Mr Gyllenhammar was one of the first to publicly draw attention to this fact. Increasing absenteeism was one of the elements to combat because it was evident that it demanded economic resources.

It would be appropriate at this point to update the discussion from May and June of 1976. I will do so by recapitulating Mr Gyllenhammar´s proposal:

> "Individuals should have the freedom of choosing their own rhythm and their ideal work input. Instead of being forced into an 8-hour or 6-hour working day, based on the approach that work is something negative which should be reduced, individuals should be given the right to decide on their working hours per week, and then sign an agreement accordingly."

The working hours would still have to be agreed upon by both management and trade unions but the general contract would be tailored to each individual's needs.

> "In present-day Swedish society, it has now become matter of course that every individual must be able to afford to be ill. The right of individuals to determine their physical and psychological condition and then decide whether or not they are fit for work, without always having to consult a physician, is also gaining widespread acceptance. The fact that the earlier qualifying period before benefits were payable has been discontinued has contributed to this new approach.
>
> During the past decade, absenteeism in Sweden has basically doubled. The absenteeism of hourly-paid employees in large companies in towns and cities is now more than 20%. In the case of a factory of about the size of the Volvo Torslanda Plant, employing more than 8,000 people, an absenteeism figure of 20% implies that about 1,600 additional people must be employed in production in order to compensate for normal absenteeism and keep the production rate intact.
>
> The economic effects of absenteeism on the society and the company are significant."

Over a number of years, we have found it easier to affect personnel turnover than absenteeism by implementing new ways of organizing work. Without any real scientific proof we would today argue that there are more factors than the job itself that influence absenteeism. Continuing the quotation from Mr Gyllenhammar:

> "Absenteeism is now a joint concept covering various types of problems which give rise to it, such as the social problems of a member of a family who has not solved the worry of child care. Absenteeism can, undeniably, be justified, even though it cannot be backed up by medical reasons in this particular case. Let us not penalise such absenteeism or moralise on it. It is far better to tackle the cause.

> Let us assume that people are created so that they cannot have the same attitude to their work and can devote eight hours a day to it. Let us also assume that there are people who can conceivably work at least eight hours, whereas others can or wish to devote a minimum time to gainful employment. Instead of forcing everybody into working an eight-hour or six-hour day, based on the principle that work is something negative which should be reduced, we could allow individuals to decide beforehand what amount of the time they want to devote to work every week. We assume that individuals have the independence and maturity to be able to decide for themselves their rhythm of life and ideal work input. They can then enter into a form of agreement with their employers for a certain period of time. At the end of the period of agreement, they would be free to re-assess their work input.
>
> Even if such agreements were to be signed, a certain amount of absenteeism would still have to be considered within the framework of the agreement. However, since the individual would then have complete freedom of choice, there would be no reason for accepting anything other than absence on medical grounds. So the new system would not have to consider anything other than very moderate absenteeism and the production machinery could then rely on its personnel resources and carry out personnel management duties in a satisfactory and efficient manner.
>
> If a model of this type is not regarded as acceptable, a more restrictive system should be adopted than that employed at present, whereby a number of medical and social factors affect the presence of the employee at his workplace and causes absenteeism to be regarded as a statistical item rather than reflecting the health conditions in the country."

The economic implications of absenteeism are vast, for the company and for the entire society. For many years we at Volvo have illustrated the costs involved by applying a so-called "social accounting model". In the following section the use of such a technique is used on two real cases from our engine manufacturing operations.

VOLVO

Application of social accounting

The form of economic analysis of social systems used up to now within companies has, with few exceptions, primarily consisted of certain standardized expense estimates within the activities of personnel administration. These estimates have primarily been used for comparisons between companies or branches. These comparisons in themselves are applicable but provide no information as to whether investments or resources are over-dimensioned or under-dimensioned or are being used in the most suitable way. Most important of all, they are not placed in relation to any form of "income measurement".

An appraisal situation which is important, and where economic consideration should play its part, consists of the choice of strategy and, thereby, the basis for the amount and allocation of resources.

Social calculations can provide an important basis for decision-making in such a context, particularly when planning moves beyond functional considerations to a systematic view of the whole organization with analyses of the technical, administrative and social systems and their mutual dependence and balance or imbalance.

For Volvo this new thinking has been important when deciding upon new technologies which have been implemented over the last few years. The new approach means a change in long-range strategy for designing new plants as well as new forms of internal organization structures.

This case aims at describing how a new investment strategy could serve as a vehicle toward more productive development. We will then focus on "investments" in people and investments in the manufacturing process. The changes were made between 1973 and 1974.

A decision was taken in 1974 to change the process in a section of the foundry where petrol engine blocks are refined. The department presented could be characterized as being a monotonous workplace with a high noise level. Absenteeism was high as well as personnel turnover.

VOLVO

The Skövde Engine Plants in 1973 employed 3,456 blue-collar and 707 white-collar workers. In 1974 the same figures were 4,288 and 808 respectively.

	1973	1974
Average absenteeism	11.3%	12.8%
" personnel turnover	23.3%	18.6%

The refinery department employed 44 people totally in two shifts before any changes were made. Personnel turnover in 1973 was 77% and absenteeism just above 13%. Production losses occurred and some engine blocks had to go to another foundry for refinery.

A decision was taken in 1974 to mechanize the process. This led to the hard physical work being taken away and the work requiring higher qualifications including quality inspection and rectification was left for the people to perform.

The first result was a decrease in personnel demand by 36% due to the mechanization (28 people equally divided between two shifts). After the changes, no production losses have occurred. Personnel turnover decreased to just above 40% and absenteeism decreased to 8.5%.

	Before	After
Personnel turnover	77%	44%
Absenteeism	13.3%	8.5%

An attitude survey was made after the changes. It proved to be consistent with lower turnover and absenteeism. The employees noticed that their status had increased, the job position had improved as well as noise level and air pollution. Due to mechanization they felt that stress in work had increased to some extent.

The economic calculation shows the gains due to lower turnover and absenteeism.

	Cost reduction (Skr) due to:	
	less personnel turnover	less absenteeism
Recruitment	24,000	-
Training	16,500	-
Overtime	10,300	10,300
Quality	216,000	-
Production losses	26,000	26,000
TOTAL	292,800	36,300

As can be read from this case, the very high turnover rate did mean extensive production costs particularly related to the manufacturing process itself (quality costs and production losses).

Besides the effect of decreased absenteeism and turnover the direct result of rationalization due to less manpower needed meant a cost reduction of Skr 850,000.

Production losses, rejected components and quality costs were all high before the changes but decreased considerably as a consequence of actions taken.

The high initial turnover rate meant that several people stayed just for a few months which had a direct effect on the manufacturing costs.

There is, for instance, a correlation between rejects and rectification costs on one hand and period of employment on the other.

The model has been extended to comprise community and state effects of the reductions in personnel turnover and absenteeism. It has proved to be an effective vehicle for opening up communications between the company and its stakeholders to apply the social accounting model.

One dimension of societal effects here accounted for comprises the financial resources needed to take care of personnel problems. By financial resources we imply public resources which are demanded (budgets for government and community spending). Financial resources do not affect necessarily real production output.

The financial calculation has been divided into:

- state effects
- municipal effects

The effect of a lower absenteeism level would be decreased pay from sickness insurance (state). The difference between sickness pay and wages would lead to more taxes for both the state and the municipality (increase in gross income). Finally, because of production added (productivity increase) there will be additional tax benefits.

Summary of decreased demand on financial resources (Skr)

	Refinery department
STATE	
decreased sickness pay	15,500
increased taxes due to	
- higher income	345
- productivity increase	314,700
Total	330,545
MUNICIPALITY	
increased taxes due to	
- higher income	580
- productivity increase	217,900
Total	218,480

Total societal effects in terms of reduction in financial resources needed:

refinery department	Skr 549,025

As has been described in this case, although the department as such is small, the economic implications are extensive. On a corporate scale we can realistically consider the potential savings to amount to millions.

The development of planning methods

Mr Gyllenhammar´s suggestion concerning working schedules aims at an improved planning situation for the work place. Certain types of absenteeism are easier to predict than others.

I would here like to differentiate between three categories of absences according to the degree of predictability:

1 short term sicknesses which are not possible to foresee

2 medium and long term absenteeism, the occurrence of which cannot be foreseen in advance at what time it will occur. Once it has occurred one can predict the duration and plan accordingly

A special group within this category is, for example, when a certain epidemic flu can be foreseen in advance

3 Absences with high predictability such as maternity leave, military leave and study leave

To grasp the increasingly complex problem of absenteeism we need to know more about people´s attitudes and their background in terms of family situation, leisure time activities etc.

Within Volvo we are at present developing a model to explore the need for flexibility in work-time for different groups and to match this with the legal possibilities of absences.

Based on the findings we will then apply the simulation technique to test out certain hypotheses of probable work-hours rate per group.

Two important questions to be answered are:

1 What are the legal grounds for absenteeism?

2 How do we estimate the pattern and rate of absenteeism for different categories of people?

The most important laws are in summary:

a) Parental leave (maternity/paternity leave) - child care

= offers parents an opportunity for child care including pregnancy benefit, parent benefits in connection with birth, for occasional care and special parents' benefits

- leave for 180 days to be apportioned between the parents when a child is born. The mother can choose to draw 60 days of these prior to delivery

- occasional care of children up to the age of 12. Benefits are due for a maximum of 60 days per child and year

- special parents' allowance up to a maximum of 90 days by the time the child reaches its eighth birthday

Parents can also choose a six-hour work day up to the age of eight with no extra benefits.

To be able to plan for these leaves, it is important to know the child-care situation, distribution of responsibility between parents and their attitude toward child care.

b) Study leave

= leave for any formal studies, short and long term (formal school programs, university programs, courses)

Can be planned for. Important for management to know about ambitions concerning individual development.

c) Language training for foreign employees

= each employee has the right to 240 hours of language training in Swedish. Through local agreements courses take place during working hours for 50 percent or more of the time.

Can be planned for. Individual needs have to be known.

d) Vacation leave

= five weeks of vacation for everyone. The fifth week can be accumulated during five years after which the employee can take ten weeks of vacation. This benefit is transferable from one employer to the other.

Can be planned for but demands good contacts between the manager and his/her subordinate.

e) Part time pension

= from the age of 60 an employee can apply for a part time pension. "Part time" implies that the working week has to be a minimum of 17 hours and a maximum of 35 hours. The allocation of time during a week has to be discussed on an individual basis.

Can be planned for but demands discussions before the age of 60.

f) Work environment

= a number of restrictions on the length of continuous work, rest periods which have to be scheduled for etc.

Has to be integrated into the work schedule. Can be planned collectively.

g) Time for union work

= union officials have the right to take necessary time-off for union duties with full pay.

Good relations between management and unions are a prerequisite to plan these absences.

h) Flexible working hours for white-collar employees

= 40 hours working week; work starts between 7.00-9.00 and ends between 16.00-18.00. The daily working hours may vary.

Individual habit and needs have to be known.

i) Military service

Can be planned for in advance.

In addition to these "institutional" reasons for absenteeism the pattern of sickness absenteeism has to be surveyed for different categories of people, their job and life situation.

A great deal of further work has to be done to relate absenteeism to background factors including job situation and "lifestyles".

Within the company a number of alternative work schedules have already been applied. In the following picture (Appendix) one case illustrates the point. Maybe the most interesting combination of work schedules is 3x6 hour shift work.

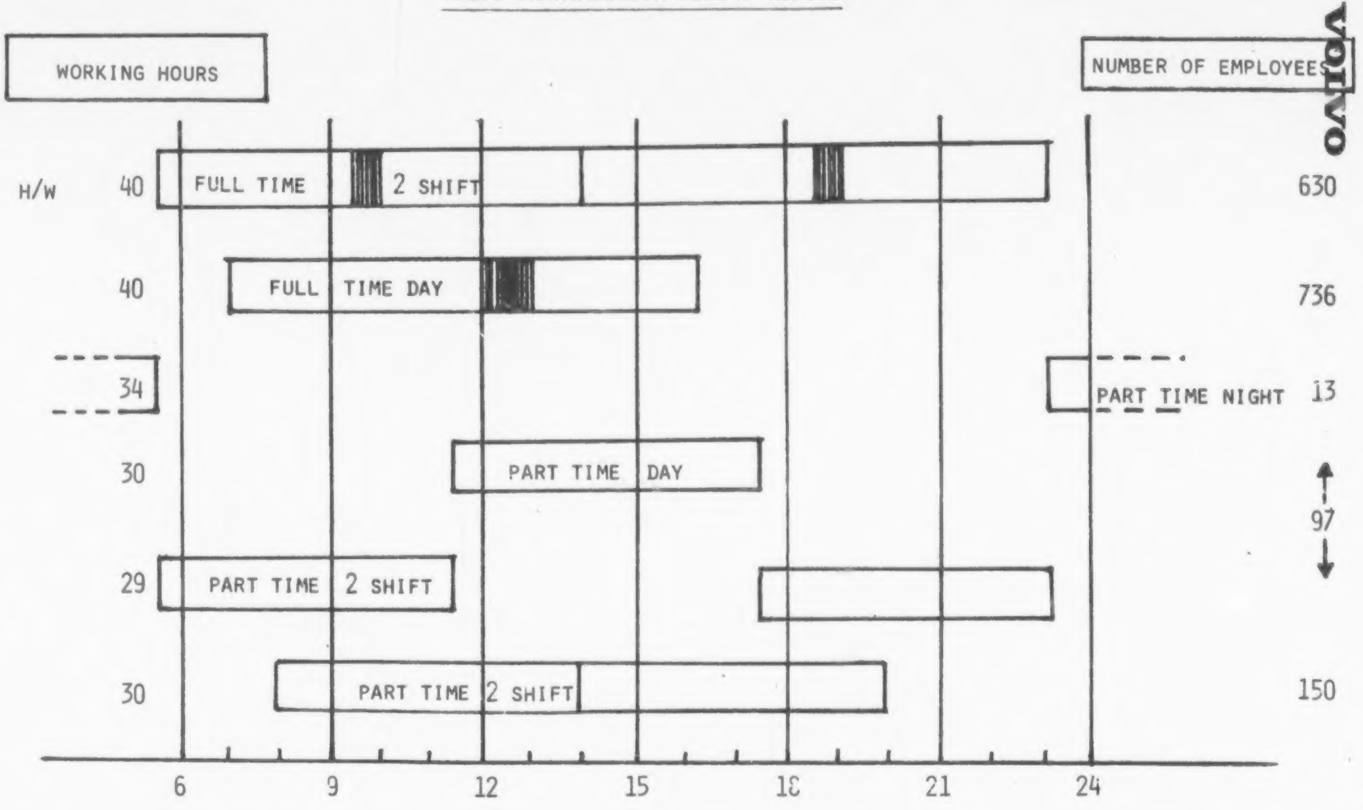
The department which first started this alternative was set up around a new component. Work design and resource allocation was totally based on 18 hours of daily work divided between three employees. The new shift schedule attracted more applications than usual and has remained very popular.

Almost all of the employees that applied for these jobs were women. People working morning and evening shifts change every week, while employees on day schedule shifts stick to their dayshift.

It goes without saying that the increased variety and flexibility in work schedules also demands more of administrative support systems, new forms of organizing work and management initiatives and imagination.

It is a safe prediction, however, to say that people appreciate a free choice of working hours as part of the improvement of their lives and will do so even more during the 80´s.

VOLVO TRANSMISSION PLANT, KÖPING



Mr. LUNDINE. We will now call on Joji Arai, the manager of the U.S. office of the Japan Productivity Center, and Douglas White, senior vice president of the American Productivity Center.

Mr. White joined the American Productivity Center after serving as vice president of human resources of the Transportation Equipment Group of Borg-Warner Corp. Mr. Arai has been affiliated with the Japan Productivity Center for some time. We welcome you and look forward to your testimony.

I think that we have both of your testimony prepared in writing. Your entire statements will be made a part of the record. You may proceed now in any manner you see fit. I guess we'll go by alphabetical order. I chuckle, if I can be allowed to clutter up this record with another observation—one of the witnesses, Mr. Brooks, yesterday said that in our penchant for individualism we often don't take into account protocol as much as other countries do. He was on a foreign mission to a Communist country, and when they got there one of the things that their hosts wanted to know was, what is the protocol here? I mean who is more equal than other? And they hadn't given it any thought so they said, well, go in alphabetical order. And Brooks said that that was the only time that having a name started with "B" ever got him a lot of other perks that others didn't get. So we'll go.

Mr. Arai, welcome, and we look forward to your testimony.

[The biographical sketches of Messrs. Arai and White follow:]

JOJI ARAI

Date of Birth: July 26, 1931

Present Address:
5208 Tamar Woods Court
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Occupation:
Manager, U.S. Office
Japan Productivity Center
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Washington, D.C. 20036

EDUCATIONAL BACKGROUND:

Keio University
Law Major
(April 1954/March 1957)

OCCUPATIONAL BACKGROUND:

August 57-December 60	Claims Investigator Staff, Judge Advocate United States Air Force Johnson Air Base, Japan
December 60-May 62	Escort/Interpreter Agency for International Development Washington, D.C.
May 62-April 65	Program Coordinator U.S. Office Japan Productivity Center
May 65-March 71	Assistant Manager U.S. Office Japan Productivity Center
April 71-	Manager U.S. Office Japan Productivity Center

DOUGLAS WHITE
Senior Vice President
American Productivity Center

Mr. White is responsible for the American Productivity Center's Labor/Management and Employee Involvement activities. The Center's resources in these efforts are predominately committed to the steel industry.

He joined the Center after serving as Vice President of Human Resources of the Transportation Equipment group of Borg-Warner Corporation. He was responsible for policy and direction of a full range of human resource activities for an international group of 30 operating divisions with 20,000 employees in 12 countries.

A long time resident of Detroit, Mr. White was Executive Director of the Detroit Industrial Mission, a community-based agency which resolved industrial conflicts and developed quality of work life programs in the major industries of Detroit. He is a co-founder of the Michigan Quality of Work Life Council, a non-profit public corporation devoted to establishing labor/management committees in the state of Michigan.

With over 20 years of management experience in human resources planning, organizational development, employee relations and community affairs, Mr. White has a Masters Degree in Industrial Ethics with graduate studies at Harvard, Stanford, and Columbia Schools of Business. He is a member of the Human Resource Planning Society and the Organization Development Network.

* * *

The American Productivity Center provides American business, labor, and government a major resource for the achievement of significant gains in productivity and quality of work life. It is dedicated to strengthing the free enterprise system through improving productivity and quality of work life in the United States.

The Center is non-profit and is supported by private contributions from over 200 major corporations and foundations. Services are provided to individual companies, industry groups, unions as well as Sponsors and Members of the Center. They include information, education and training assistance, the design and implementation of productivity measurement and improvement programs and advisory services.

STATEMENT OF JOJI ARAI, MANAGER, U.S. OFFICE, JAPAN PRODUCTIVITY CENTER, WASHINGTON, D.C.; AND DOUGLAS WHITE, SENIOR VICE PRESIDENT, AMERICAN PRODUCTIVITY CENTER, HOUSTON, TEX.

Mr. ARAI. Thank you very much, Mr. Chairman, distinguished members of the committee; I am grateful for the opportunity to describe the Japanese experiences in the area of productivity innovation.

Japan's industry has registered an annual rise of 8.9 percent in productivity in the last 2½ decades. This has been due primarily to an accelerated increase in capital investment, research and development efforts, systems improvement, improved quality of the work force, stringent quality control of products and services, and management systems that place heavy emphasis on the harmonious involvement of managers and workers in attaining strategic goals of their organizations. The egalitarian nature of this homogeneous society especially enabled the Japanese to maximize the effects of various human input, resulting in the high performance of Japanese corporations.

Although Japan currently ranks third after the United States and the U.S.S.R. in the aggregate amount of a $20 billion investment in research and development, much of her effort has been directed toward improving existing technologies and the development of commercial products, especially consumer products as compared to American and European efforts to conduct basic research and develop industrial products.

In addition, her effort to shorten the period required for technology transfer, due to the heavy burden on the private sectors to bear 75 percent of the cost of research as compared to 50 percent in the United States and Europe, often gave her a competitive edge in the global market.

This can be clearly observed when one compares the educational background of chief executive officers of major Japanese and American corporations.

Thirty-six percent of Japanese CEO's of the 200 largest companies have engineering backgrounds as compared to 18 percent of their American counterparts. Furthermore, 52 percent of Japanese manufacturing companies have engineering-oriented CEO's.

The serious involvement of both management and workers in improving quality standards through structuring quality-oriented organizations, applying improved production control systems, and the wide use of quality work life circle programs of workers reduced the defect ratio of many Japanese products to one-tenth to one-twenty-fifth of those of their American and European competitors.

The large number of patent registrations—that is about 55,000 per year in domestic registrations and 6,500 in the United States representing almost 10 percent of total patent registrations in the United States that is filed by Japanese in recent years—gives one the impression that they are innovative.

The majority of Japanese accomplishments can only be classified as substantial technological progress and improvement of existing technology.

Unlike the United States where over 25 percent of innovations constitute technological breakthrough, only 8 percent of Japan's does.

Also interesting to note, between 1901 and 1980 3 Japanese scientists received the Nobel Prize, as compared to 121 American recipients.

As of 1978 our trade account of technology with the United States showed a deficit of $450 million.

Until now the Japanese economy has enjoyed the highest growth performance record among the industrialized nations based upon the improvement of existing technology which was accomplished largely by engineers trained in-house by companies through many years on OJT programs and their group efforts irrespective of their disciplines and scope of duties.

However, Japan is now starting to feel a pressure from other Asian countries which patterned their technological progress on that of Japan. In order to remain competitive in the global market and to contribute toward improving the standard of living of people of the world Japan needs to produce a large number of creative people who can work outside the constraints of Japanese organizations.

Of the total research cost of an average Japanese company 50 percent represents personnel cost. In the future it is imperative for Japanese management to create an environment where traditional peer pressure and a consensus-based decisionmaking system does not interfere with the work of researchers.

To Japanese productivity does not mean the mere measurement of output divided by input. It means a state of mind that is being confident that tomorrow can be made better than today. They will continue to change and strive for a better tomorrow.

In closing I'd like to mention the fact that the Japan Productivity Center is a nonprofit, nongovernmental institution promoting the cause of productivity. Your letter mentioned that the Japan Productivity Center is a governmental institution unlike the American Productivity Center, but the organizational structure as well as its function is almost identical.

Thank you.

Mr. LUNDINE. Thank you.

[The prepared statement of Joji Arai follows:]

PREPARED STATEMENT OF JOJI ARAI

Japan's industry has registered an annual rise of 8.9 percent in productivity in the last two and one half decades. This has been due primarily to an accelerated increase in capital investment, research and development efforts, systems improvement, improved quality of the work force, stringent quality control of products and services, and management systems that place heavy emphasis on the harmonious involvement of managers and workers in attaining strategic goals of their organizations. The egalitarian nature of this homogeneous society especially enabled the Japanese to maximize the effects of various human input, resulting in the high performance of Japanese corporations.

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Mr. LUNDINE. Mr. White.

Mr. WHITE. Thank you, Mr. Chairman. I am honored to testify before your committee today, and it's particularly gratifying to me that a committee that examines issues of science and technology has committed 6 days of hearings to exploring the human impact of science and technology in the workplace.

I hope that out of this experience will come a clear direction not only for this committee and for the Congress but for the country as well.

I am particularly pleased to appear on a panel with Mr. Arai who has devoted himself to helping Americans in business, trade unions and government to better understand the dramatic emergence of Japan as a dynamic force in the worldwide economy in the years since World War II.

Recently Mr. Arai accompanied U.S. business and government leaders on a 10-day study mission to Japan. And this trip was initiated and sponsored by the American Productivity Center.

As Mr. Arai just pointed out both the Japan Productivity Center and the American Productivity Center share the objective of promoting widespread understanding of productivity in our respective countries. However, the Japan Productivity Center has had 20 years more experience, a larger staff and budget to meet this objective. Both organizations are nonprofit, privately funded, and governed by a board of business, labor, government, and academic leaders.

Both are working to develop and apply specific knowledge essential to nationwide improvement in productivity and quality of worklife. We work similarly at all levels—individual firms on an industrywide basis, with trade unions, and all levels of government seeking opportunities to raise awareness and improve productivity and quality of worklife.

Both provide education and training as well as advisory assistance to meet these goals.

One of the areas that's a priority for both our organizations is activities that will assist companies and unions to build greater employee involvement. I am responsible for these activities at the American Productivity Center.

In many cases the vehicle for employee involvement is the establishment of joint labor/management committees for productivity and quality of worklife improvement.

In other cases it's been the establishment of improved two-way communication, group problem-solving, and increased participation and decisionmaking at all levels in a company to address quality, productivity, and work-relationship issues.

Over the past several years the center has worked with a wide variety of companies and industries. Most recently our resources have been heavily committed to assisting the United Steelworkers and several major steel companies in the implementation of joint participation teams which grew out of an appendix to their last round of collective bargaining in 1980.

I come before you today bringing a background of some 15 years experience in organizational change. Supporting that experience is a strong value commitment to the dignity and worth of workers at whatever level they may be in an organizational structure. This is accompanied by a deep conviction that the greatest untapped resource in this country today is the minds of our workers.

For me the single most important task in restoring the economic well-being of this country is the removal of the barriers which impede and inhibit the full participation and involvement of people in their work. Appropriate and well-managed methods for involvement and participation can increase overall organization effectiveness by broadening the input to decisions. At the same time these methods help earn employee commitment to successful implementation of those decisions.

Unless this perspective is at the forefront of our considerations of scientific and technological innovation we will continue to fail to realize our full potential for economic development, in fact even economic survival.

The impact of scientific and technological innovations is still largely dependent upon people. It is people who design, implement, and utilize technological systems. To be successful a technological system must be understood and accepted by the people it affects.

There are many technical systems which have failed because people were not motivated to adapt it to their use. Participation and involvement offers the key to fully realizing the potential benefits of scientific and technological innovations.

This task requires no great theory—just hard work, honesty, and trust between the parties. It's not the whole answer but it's a task that can be worked at at any level—individual firm, local union, community, State, industrywide, corporate board rooms, and international executive boards of trade unions.

It is quite simply the task of bringing people together in an atmosphere in which two parties can seek and find a common interest. That's something I can do; that's something that you can do in your constituencies and can support at a national level.

The current climate in this country, it would appear, is unlikely to foster labor-management cooperation. Labor, quite understandably, sees itself under attack from many quarters. The political environment, public sentiment and economic conditions have placed labor in this country in a defensive position.

For example, signaled by the wage rate concessions negotiated at Chrysler, major auto companies are desperately seeking ways to reopen their contracts on that issue. The wounds have not yet healed from the polarizing conflict over the enactment of the National Labor Reform Act. There is intense squabbling over decreasing pieces of a shrinking pie.

Increasingly the phase, "There must be a better way," is heard out of the desperation of our current situation. There are a couple of familiar stories where we first heard that phrase.

The Jamestown, N.Y., labor-management project and the General Motors assembly plant in Tarrytown, N.Y., have become classics of labor-management relations. You know these stories well, Mr. Chairman, and played a key role in their development. Had not an acute sense of common interest, the sense of a "better way" emerged, Jamestown and Tarrytown today might well be decimated communities.

There are other success stories that need to be told. They illustrate what can be done when courageous individuals decide to take the first steps in identifying and working toward common goals, instead of the win-lose approach which inevitably turns to a lose-lose situation for all parties.

One is the story of Muskegon, Mich., and in the written testimony I've described the development and impact of labor-management forums in this community.

Another story which I believe typifies what we are here to discuss today centers on a small iron foundry located in Indiana. It is unique because of the simplicity of its success.

Labor-management relationships at this foundry had been strained historically; it was a classic case of management insisting on its right to manage while workers—in this case the United Steelworkers—were satisfied to "let the bosses take the losses."

The spark that ignited the quality-of-worklife process at this foundry was a grievance filed about the exhaust system in one section of the plant. The core-making section. Coincidentally with the purpose of this committee's hearings the exhaust system was a technological innovation which had been introduced in that operation, yet it created grievances.

As management and labor gathered together to solve their problems they found that they had a common interest, and through a series of processes facilitated by the American Productivity Center they wound up together meeting at Linden Hall—a United Steelworkers education and training center outside of Pittsburgh, Pa.

Two people from the American Productivity Center assisted and facilitated their working together. The outcome of their meeting points toward the simplicity which is at the root of labor-management cooperation.

At the conclusion of their meeting these foundry people who had been fighting each other for years made one simple commitment. It read, "We the undersigned are committed to tearing down the wall." Each individual signed his name to this piece of paper. In addition, they agreed to the formation of a formal structure which in this case they called a Quality of Work Life Committee that would work in every section of the foundry.

A newsletter account of the experience at Linden Hall reports their pledge. Their words are very powerful—as powerful as the energy that exists when two forces are united. I have enclosed as an appendix to this testimony the newsletter account that was written by the joint labor-management group in this foundry.

The bottom line of labor-management efforts such as I have just described is a payoff not only to labor, management, and workers, but also to American industries and the communities in which they are located.

Doug Fraser, president of the United Auto Workers Union has cited positive gains relating to improved productivity from the joint quality-of-worklife programs undertaken by the UAW and the General Motors Corp., as well as the employee-involvement process between the UAW and the Ford Motor Co.

He lists the positive outcomes as including: Improved collective bargaining relationships, a more satisfied work force, better product quality with less scrap and fewer repairs, fewer grievances as problems more frequently get resolved on the shop floor less absenteeism, lower labor turnover, and Fewer disciplinary layoffs and discharges.

As another benefit, Irving Bluestone, former vice president of the UAW General Motors Department has cited a marked increase in local union leadership continuity where there has been a history of quality of worklife and joint labor-management cooperative activity. A significantly higher percentage of incumbent local union leaders have been reelected to office in organizations where quality-of-worklife programs were active.

One of the most positive outcomes of joint labor-management cooperation is that it commences at the grassroots level and tends to keep people working and communities thriving. It allows us to live close to our roots and family traditions.

Having recently moved from Detroit to Houston, Tex., I am acutely aware of the mass migration that is taking place in this country. One simply has to ride the planes or drive the highways between Detroit and Houston to experience first-hand the family trauma and disorientation which is affecting thousands of American families as they pull up roots, migrate from a perilous situation desperately searching for new hope and for a new land of promise.

There is a strong tradition in this country of picking up and moving in order to find a better life. It started with the pilgrims escaping tyranny, seeking freedom. And behind them came the thousands of immigrants who poured through Ellis Island in New York and found jobs in the industrial heartland of America. That's a strong tradition which should not be lost.

But plant closing and the exportation of jobs are not a logical consequence of our pioneering spirit. They are wasteful. Go to Lawrence or Lowell or New Bedford, Mass., and see the massive brick mills which stretch for miles and which have stood empty for half a century in the wake of the textile industry's migration to the South.

Look at the cavernous unused space in the steel mills in Pennsylvania, the auto plants in Michigan, Indiana, and Ohio, the cities like Cleveland and Detroit that are gasping for survival as their economic base withers—leaving them without the resources to meet human need.

Running away from problems is not part of our tradition. Staying and working together to solve problems is a strong part of our tradition. Support for labor-management cooperation keeps people in place. It keeps people's dignity in place.

While labor-management cooperation is not the only thing we should be doing it clearly is one of the first things we should be doing.

I am committed to making labor-management cooperation a reality in this country. Using this vehicle, this better way, we can prevent the further erosion of our industries, our cities, and our people's lives.

Mr. Chairman, I thank you for this opportunity to address this committee, the center shares your hope that out of these 6 days of hearings will come a clear sense of direction and priority for labor-management cooperation. Surely that will allow working men and women in the United States once again to hold their heads high, knowing the quality of their products and services are valued both here at home and in the worldwide marketplace.

Mr. LUNDINE. Thank you.

[The prepared statement of Douglas White and attachment follow:]

House Committee on Science and Technology
September 11, 1981
Douglas White, Senior Vice President
American Productivity Center
Houston, Texas

Mr. Chairman, I am honored to testify before your committee today. It's particularly gratifying that a committee which examines issues of science and technology has committed six days of hearings to exploring the human impact that science and technology have in the workplace. I hope that out of this experience will come a clear direction not only for the committee and the Congress but for the country as well.

I am pleased to appear on a panel with Mr. Arai who has devoted himself to helping Americans in business, trade unions and government better understand the dramatic emergence of Japan as a dynamic force in the worldwide economy in the years since World War II. Recently, Mr. Arai accompanied U.S. business, and government leaders on a 10-day study mission to Japan. This trip was initiated and sponsored by the American Productivity Center.

Both the Japan Productivity Center and the American Productivity Center share the objective of promoting widespread understanding of productivity in our respective countries. However, the JPC has had 20 years more experience, a larger staff and budget to meet this objective.

Both organizations are nonprofit, privately funded and governed by a board of business, labor, government and academic leaders. Both are working to develop and apply specific knowledge essential to nationwide improvement of productivity and quality of work life. We work similarily at all levels -- individual firms, on an industry-wide basis, with trade unions, and all levels of government -- seeking opportunities to raise awareness and improve productivity and quality of work life. Both provide education, training as well as advisory assistance to meet these goals.

The Japan Productivity Center's networking and structure of affiliated organizations is certainly one key to its success as a vehicle to raise awareness and gain commitment on the issues involved in productivity improvement.

One of the areas that is a priority for both our organizations is activities that will assist companies and unions build greater employee involvement. I am responsible for these activities at the American Productivity Center. In many cases, the vehicle for employee involvement is establishment of joint labor/management committees for productivity and quality of work life improvement. In other cases, it has been the establishment of improved two-way communication, group problem-solving and increased participation and decision-making at all levels in a company to address quality, productivity and work relationship issues.

Over the past several years, the Center has worked with a wide variety of companies and industries. Most recently our resources have been heavily committed to assisting the United Steel Workers and several major steel companies in the implementation of joint participation teams which grew out of their last round of collective bargaining.

Prior to joining the American Productivity Center, I was Vice President of Human Resources for the transportation equipment group of Borg Warner Corporation. This heavily auto-related business is comprised of approximately 30 operating divisions with some 20,000 employees in 12 countries. A major objective of the corporation over the past several years has been improving the quality of work life in its operations both here and abroad. Prior to Borg Warner, I directed the Detroit Industrial Mission, whose purpose was the resolution of industrial conflict and the enhancement of the quality of work life in industrial plants. Among the clients of this agency were the major automobile companies and other industrial and service firms primarily located in the Michigan area.

I therefore come before you today bringing a background of some 15 years experience in organizational change. Supporting that experience is a strong value commitment to the dignity and worth of workers at whatever level they may be in an organizational structure. This is accompanied by a deep conviction that the greatest untapped resource in this country today is the minds of our workers. For me, the single most important task in restoring the economic well-being of this country is the removal of the barriers which impede and inhibit the full participation and involvement of people in their work. Appropriate and well-managed methods for involvement and participation can increase overall organization effectiveness by broading input to decisions. At the same time, these methods help earn employee commitment to successful implementation of those decisions. Unless this perspective is at the forefront in our considerations of scientific and technological innovation, we will continue to fail to realize our full potential for economic development, in fact even economic survival.

The impact of scientific and technological innovations is still largely dependent on people. It is people who design, implement and utilize technological systems. To be successful a technological system must be understood and accepted by the people that it affects. There are many technical systems which have failed because people were not motivated to adapt to their use. Participation and involvement offers a key to fully realizing the potential benefits of scientific and technological innovations.

Dr. Grayson, Chairman of the American Productivity Center, has on numerous occasions called for the implementation of a multi-faceted national productivity program. He appeared before the Joint Economic Committee of the U.S. Congress in February of 1979 and again in June, 1981. The outline of that plan has been attached to my testimony for the committee's review.

The need to build a national commitment for productivity and quality of work life improvement along the lines outlined by the American Productivity Center has never been greater. We now have the opportunity to build this commitment from the growing awareness of productivity and related issues.

However, I am not very optimistic that we will come to this kind of a comprehensive strategy until the pain of our economy and our declining position in the world gets dramatically worse. While Dr. Grayson and others have been sounding the alarm throughout the past decade, the responses have been meager, ill-conceived, and lacking meaningful commitment.

To broaden the consensus for productivity and quality of work life improvement each individual must ask, "What can I do at a personal level to become part of the solution?", rather than continuing to be part of the problem that we're describing. I'd like to share with you my thoughts on what can be done at a grass roots level in communities, individual workplaces, and industries which can have a significant impact on our national economy.

I mentioned earlier that for some seven years I was responsible for the conduct of human resource policy in a worldwide operation. This gave me an opportunity to observe work practices and cultures as well as the interaction of the key elements of the economy in a number of different countries. These observations led me to some very simple conclusions.

I found that the key economies in the world today can be lumped together in two groups based on similarities. One group - Germany, Japan and several of the Scandinavian countries - stands out in sharp contrast to the other group comprised of the United Kingdom, Italy, and the United States. The dominant characteristic of the first group (Germany, Japan and Scandinavia) is the high degree of interaction and interdependence of three key elements of the economy - business, labor, and government. These three forces in each country combine to focus with great intensity on one common goal: economic development. As a result, not only have they dramatically improved their own economies over the last 20-30 years, but they have also emerged as dominant forces in the worldwide economy. Significantly, their economic base has provided the foundation for broad-reaching social programs at all community levels in their societies.

This is contrasted by the character of interactions between the three key elements of the economy in the other three countries - the United Kingdom, Italy, and unfortunately, the United States. Relationships between business, government and labor in this group are, at best, adversarial. Their perspectives are fragmented. There is a high degree of blaming each other for the beleaguered conditions in these countries. There is no sense of pulling together for the common good.

In the United States it has resulted in a steadily weakening position of our major industries. Our position in the world economy is threatened. And the resources required to support the social fabric of our nation, our communities, and our cities become scarce. It's not a pretty picture. It's an enormous problem.

Increasingly we find our autocratic, top-down management style and the adversarial role between labor and management at the core of productivity and quality of work life problems at individual organizations. Helping to solve these problems, individually and nationally, has become one of the Center's priorities.

This task requires no great theory, just hard work, honesty, and trust between the parties. It's not the whole answer, but it's a task that can be worked on at any level --- individual firm, local union, community, state, industry-wide, corporate board rooms, international union executive boards. It is quite simply the task of bringing people together in an atmosphere in which two parties can seek and find a common interest. That's something I can do. That's something that you can do in your own constituencies and can support at a national level.

The current climate in the country, it would appear, is unlikely to foster labor/management cooperation. Labor, quite understandably, sees itself under attack from many quarters. The political environment, public sentiment and economic conditions have placed labor in a defensive position. For example, signaled by the wage rate concessions negotiated at Chrysler, major auto companies are desparately seeking ways to reopen their contracts on that issue. The wounds have not healed from the polarizing conflict over the enactment of the National Labor Reform Act. There is intense squabbling over decreasing pieces of a shrinking pie.

Increasingly the phrase "There must be a better way," is heard out of the desperation of our current situation. There are a couple of familiar stories where we first heard that phrase.

The Jamestown, New York labor/management project and the General Motors assembly plant in Tarrytown, New York have become classics in the history of labor/management relations. You know these stories well, Mr. Chairman and you played a key role. Had not an acute sense of common interest -- the sense of a "better way" emerged --- Jamestown and Tarrytown today might well be decimated communities.

There are other success stories that need to be told. They illustrate what can be done when courageous individuals decide to take the first steps in identifying and working toward common goals instead of the win/lose approach which inevitably turns to a lose/lose situation for all parties. One is the story of Muskegon, Michigan.

Muskegon is a medium-sized town of approximately 150,000 located on the eastern bank of Lake Michigan. It has a small industrial base and the community itself is sandwiched in between a number of resort communities along the Lake Michigan shoreline. In the 1960's the community experienced marked deterioration in what historically had been a poor labor/management climate. Additionally, a number of local businesses had been acquired by large international conglomerates. These international conglomerates had no stake in the community and were simply interested in the most efficient and effective source for the materials that they produced and marketed.

As the economic climate in Muskegon worsened and the pressures to relocate mounted, the typical pattern of mutual blaming and adversarial relationships between labor and management grew. In the meantime, the community which had its very economic survival at stake sat helplessly by as labor and management continued to bicker and blame each other for their current woes.

The final trigger for action came in 1970 with 5-month strikes at the two major employers in that city. This spurred the local economic development commission into action. They enlisted the support of two people who had been associated with the Detroit Industrial Mission to help create labor/management forums.

Initially data was gathered from the various sectors in the community. Members of management, labor, and government participated individually. This eventually led to a series of sessions in which the parties came together. They came together to examine the critical nature of the situation. They came together to solve problems and find a "better way." From this emerged a series of in plant, labor/management, group meetings to look at the problems within the respective plants. Approximately a half a dozen companies were involved in this process.

The outcome of this work led to a common identification of problems with proposed action plans and solutions. There was a joint agreement between management and labor to invest new capital and new products into existing facilities in return for assurance of productivity improvements and an end to the labor strife. What happened here, quite simply, was that all three major elements of the Muskegon economy (management, labor and government) found a common interest which was the economic survival of the community, its jobs and its people.

Like Tarrytown and Jamestown, New York, had not the labor/management forum project been successful in the early 1970's in Muskegon, this community too would look much like wasted facilities that mark so much of our industrial landscape.

Another story which I believe typifies what we are here to discuss today centers on a small iron foundry located in Indiana. It too has a familiar ring. And yet it is unique because of the simplicity of its success.

Labor/management relationships at the Dalton Foundries had been strained historically. It was a classic case of management insisting on its right to manage while the workers -- in this case United Steelworkers -- were satisfied to "let the bosses take the losses."

The spark that ignited the quality of work life process at the foundry was a grievance filed about the exhaust system in one section of the plant -- the core-making section.

As the department management and hourly workers tried to solve the problem, they discovered they needed help from other departments in the plant. Greater involvement of union and management people from the plant brought forth new ideas and solutions --- and some new problems!

As management and labor began to experience working together, solving problems together, they were led to consider the possibility of beginning to change their traditional working relationships. They sought out examples from other firms and industries. The group visited General Motors, Buick Operations, in Flint, Michigan, to learn first hand how labor/management had worked there. Reinforced by what they saw, the group called on the American Productivity Center to help expand their initial success.

APC provided the neutral party as a small group of these management and labor people gathered together in a local union hall to explore the possibilities of a new relationship. Encouraged, the group resolved to spend three days away from the foundry at an APC structured session.

They met at Linden Hall, a United Steelworkers Education and Training Center, outside of Pittsburgh, Pennsylvania. Again two people from the American Productivity Center assisted and facilitated their working together. The outcome of their meeting points toward the simplicity which is at the root of labor/management cooperation.

At the conclusion of their meeting, these foundry people who had been fighting each other for years made a commitment. It simply read: "We the undersigned are commited to tearing down the wall." Each individual signed his name to this piece of paper. In addition they agreed to the formation of a formal structure which, in this case, they called a quality of work life committee that would work in every section of the foundry.

A newsletter account of the experience at Linden Hall reports their pledge. Their words are very powerful -- as powerful as the energy that exists when two forces are united. I have enclosed as an appendix to this testimony the newsletter account that was written by the joint labor/management group in this foundry.

The bottom line of labor/management efforts such as I have just described is a payoff to not only labor, management and workers but also to American industries and the communities in which they are located.

Douglas Fraser, President of the United Autoworkers Union has cited positive gains relating to improved productivity from the joint quality of work life programs undertaken by the UAW and the General Motors Corporation as well as the employee involvement process between the UAW and the Ford Motor Company. He lists the positive outcomes as including:

- improved collective bargaining relationships,
- a more satisfied work force,
- better product quality with less scrap and fewer repairs,
- fewer grievances as problems more frequently get resolved on the shop floor,
- less absenteeism,
- lower labor turnover, and
- fewer disciplinary layoffs and discharges.

As another benefit, Irving Bluestone, former Vice President of the UAW General Motors Department has cited a marked increase in local union leadership continuity where there has been a history of quality of work life and joint labor/management cooperative activity. A significantly higher percentage of incumbent local union leaders have been re-elected to office in organizations where quality of work life programs are active.

One of the most positive outcomes is the fact that joint labor/management cooperation which commences at the grass roots level tends to keep people working and communities thriving. It allows us to live close to our roots and family traditions.

Having recently moved from Detroit to Houston, Texas, I am accutely aware of the mass migration which is currently underway in this country. One simply has to ride the planes or drive the highways between Detroit and Houston to experience first-hand the family trauma and disorientation which is affecting thousands of American families as they pull up roots, migrate from a perilous situation desperately searching for new hope and for a new land of promise.

There is a strong tradition in this country of picking up and moving in order to find a better life. It started with the pilgrims escaping tyranny, seeking freedom. Behind them came the thousand of immigrants who poured through Ellis Island in New York to seek jobs in the industrial heart land of America. That is a strong tradition which should not be lost.

But plant closings and the exportation of jobs are not logical consequences of our pioneering spirit. They are wasteful. Go to Lawrence or Lowell or New Bedford, Massachuesetts, and see the massive brick mills which stretch for miles and which have stood empty for half a century in the wake of the textile industry's migration to the south. Look at the cavernous unused space in the steel mills in Pennsylvania, the auto plants of Michigan, Indiana, and Ohio, the cities like Cleveland and Detroit that are gasping for survival as their economic base withers leaving them without the resources to meet human need.

Running away from problems is not part of our tradition. Staying and working together to solve problems is a strong part of our tradition. Support for labor/management cooperation keeps people in place. It keeps people's dignity in place.

Mr. Chairman, I would like to close on a personal note drawn from an experience many of us shared. Behavioral scientists have given us abundant evidence that our value formation and expectations regarding life are largely set during the formative years between ages nine and twelve.

I am 49 years old. That formative period in my life took place between 1941 and 1944. As 1941 ended, this country was reeling from the initial shock of war. As a nation, we faced a threat of our very survival. Yet in three short years America witnessed the greatest coming together of its common interest and cause that had ever occurred. Gradually, as cooperation heightened management, labor, and government worked around the clock to fashion what was called "the arsenal of democracy."

I will never forget the excitement and optimism that I felt as a young boy witnessing what a dramatic turn around that can be accomplished in the face of adversity. I remain firmly convinced that when everyone pulls together this country can do virtually anything.

There is a striking parallel between today and December, 1941. Our fleet is once again on its side and smoldering. This time it is not our war ships, it is our major industries -- auto, steel, electronics, high technology. Our markets, at home and abroad, are threatened. As a people we are divided. There is not a common sense of purpose among labor, management, and government in this country today.

Yet we have the capability of pulling together. While labor/management cooperation is not the only thing we should be doing, it is clearly one of the first things that we should be doing. I am committed to making labor/management cooperation a reality in this country. Using this vehicle, this "better way," we can prevent the further erosion of our industries, our cities and our peoples lives.

Mr. Chairman, you along with the members of this committee and your other colleagues in the House and Senate can make a committment to:

- Provide support for labor/management cooperation at the national level
- Get involved in labor/management cooperation efforts within your local constituencies
- Provide support to our critical industries -- auto, steel, electronics

- Support a comprehensive national productivity and quality of work life plan as outlined by the American Productivity Center.

Mr. Chairman, I thank you for this opportunity to address this committee. The Center shares your hope that out of these six days of hearings will come a clear sense of direction and priority for labor/management cooperation. Surely that will allow working men and women in the United States once again hold their heads high knowing the quality of their products and services are valued both here at home and in the worldwide marketplace.

Appendix #1

Excerpts from:

Testimony

Joint Economic Committee Hearings
June 1, 1981

C. Jackson Grayson, Jr., Chairman
American Productivity Center
Houston, Texas

Statement before the Joint Economic Committee of the U.S. Congress

June 1, 1981

C. Jackson Grayson, Jr.
Chairman
American Productivity Center

Productivity Improvement—Critical to our Nation's Economic Health

Like getting a man on the moon, we need a national productivity goal . . . and we should be thinking in terms of doubling our level of productivity in a decade.

C. Jackson Grayson, Jr.

Chairman
American Productivity Center

There is no question that productivity improvement is one of the nation's most important economic problems—if not *the* most important. Inflation, unemployment, real earnings, and foreign competition frequently get the headlines, and each is a serious problem. But none of these can be solved on a long-term basis unless our nation's productivity growth rate improves.

Because the productivity statistics are so abysmal (three years of decline in a row in 1978, 1979, and 1980), the nation now is aware of the seriousness of the problem. A recent Louis Harris survey showed that "there is a strong and widespread recognition in the United States of the need to improve the country's productivity performance. A strong majority of Americans (79%) believe declining productivity is at least a serious problem for the next several years."

This is a dramatic change from several years ago.

This heightened awareness, while necessary, is not sufficient. Following awareness must come action. Action must involve both the public and private sectors.

Let's look first at the public sector—what has been done? Over the past few years, there has been little attention to improving productivity by either the Congressional or Executive Branch.

Rarely has productivity been considered in economic policy making, in laws, regulations, trade policies, or tax reform. Any organized efforts have been largely weak and abortive:

1. The National Commission on Productivity, founded in 1970, never attracted Presidential or Congressional support, had few staff members and no authority to carry out its mission, was underfunded, and lacked leadership and direction. It folded in 1978.
2. The Council on Wage and Price Stability was established in 1974 by a Congressional Act which stated that they were to "focus attention on the need to increase productivity in both the public and private sectors." They concentrated on influencing prices and wages, and did nothing about productivity.
3. The National Productivity Council was established by President Carter in 1978, partly to replace the defunct National Commission on Productivity. It did even less. It had no staff, was not funded, took no actions, did not involve the private sectors, and met only four times for a total of about four and a half hours since October, 1978.

The General Accounting Office recently issued performance reports on each of these efforts stating that all were largely ineffectual and that their mission to help improve productivity was not accomplished.

Likewise, neither the Department of Labor nor Department of Commerce have created, organized, or sustained programs to improve productivity.

In sum, while the rate of productivity growth has steadily declined, there has been little action at the national level.

President Reagan and the Congress both are now proposing a number of tax changes in the name of "stimulating investment and productivity."

These efforts are certainly in the right direction. But productivity improvement does not flow automatically from increased investment.

Tax changes are desirable and necessary, but they are not sufficient. More—much more—must be done in both the public and private sectors.

I have testified before this Committee on several occasions urging that steps be taken to undertake a broad, and comprehensive "National Productivity Program" involving:

- The public and private sectors
- Short- and long-range actions
- Macro policies and micro action

And such action steps must involve labor, management, and government.

I still urge such action.

Japan, facing a serious productivity stagnation and poor quality reputation in 1955, stirred itself to action with the adoption of three guiding principles:

- Productivity improvement should be done jointly with labor and management.
- Productivity improvement leads to more jobs, and temporary redundance should be dealt with by relocation.
- The fruits of improved productivity should be fairly distributed among management, labor, and consumers.

With these principles, Japanese labor, management, and government officials embarked on a national productivity effort that has resulted in one of the most amazing productivity growth records in the history of the world.

The United States should do the same.

We do not have to idolize or copy Japan, but we can certainly learn from them. And we can embark on our own improvement efforts in our own way. The essential point is that we must begin.

At the national level, I have proposed that two major steps be taken to help re-start a public sector focus on productivity:

1. The appointment of a "President's Productivity Advisory Council."

   This council would be composed of business, labor and academic leaders from the *private* sector. They would recommend policies and programs to Congress and the Administration for productivity improvement, and they would monitor and report on national progress toward productivity improvement.

   This is not a new bureaucratic body—*not* a new government agency. The members would be part-time and not compensated. It has no government members. It is advisory. And it can help to provide an interface between the public and private sectors.

2. The assignment of responsibility for productivity improvement policies and programs to an existing government agency, such as the Office of Management and Budget, Treasury, or the Federal Emergency Management Agency.

   This government agency should have a voice and influence at the highest levels of economic public policy making, and also have the influence, funding, and staff to cause productivity improvement programs to be started in every government agency.

The primary reason that this effort is needed so badly is that we simply are not *explicitly* taking productivity into consideration in our economic policies.

Peter Drucker wrote in the January-February 1981 *Harvard Business Review*:

" . . . the competitive success of Japanese industry is not the result of some uniformity of thought and action. It is the result . . . of (the habit of considering) . . . a proposed policy's impact on the productivity of Japanese industry, on Japan's competitive strength in the world market, and on Japan's balance of payments and trade."

We simply do not now do that in the United States. We need an organized effort to cause that to occur.

While the public sector must take steps along these lines, the prime responsibility for improving productivity in the private sector rests squarely on:

1. American management
2. American labor

It always has.

But, in recent years, productivity improvement simply has not been a subject of major attention by many managers or employes.

Productivity has been equated with something as vague as "motherhood," assumed to be almost automatic and frequently ignored as a critical variable for the long-run survival of a business or industry. Like good health, too often it has been "taken for granted."

Many American firms have simply taken their eye off the productivity ball.

What has just been said is certainly not true of *all* American firms. Some are extremely productive and producing goods of high quality.

This is why I am pleased that you have invited some of these organizations to testify today. These firms do not take productivity improvement for granted. They are committed to action. They have significant accomplishments to report.

As they will indicate, they still have a long way to go. They still have room for improvement. But hopefully they set an example for others to follow.

While we need national policy changes, many improvements in productivity and quality of work life are available to use right now. We do not have to wait.

While the American Productivity Center has developed its own process to examine opportunities for productivity improvement at individual organizations, there are seven key elements that companies throughout the nation can consider in their own productivity examination. (1) Resources, (2) Productivity Goals, (3) Awareness, (4) Measurement, (5) Rewards and Recognition, (6) Employe Involvement, and (7) Leadership and Organization.

Resources: How an organization uses its human, material, technological and capital resources is fundamental to the productivity equation. Determine how productively these assets are used and assess the several points where improvements will have the greatest impact on productivity.

Productivity Goals: Goals should reflect the productivity/quality-of-work-life emphasis of the organization. They also establish expectations for change and improvement.

Awareness: With effective communication, an organization can clarify its goals and expectations for productivity improvement, provide performance feedback, recognize contributions, obtain ideas for improvements and identify barriers to productivity and quality of work life.

Measurement: Through measurement, an organization can determine its level of productivity, assess its strengths and weaknesses and evaluate trends and progress.

Rewards and Recognition: "What's in it for me?" Processes are essential for encouraging and regarding the changes the organizations are seeking.

Employe Involvement: Productivity improvements are realized largely to the degree that employes get involved. If they contribute their ideas and efforts toward improvements, and experience pride in the organization's accomplishments, then the quality of work life is improved and the commitment to increased productivity is enhanced.

Leadership and Organization: The organization structure provides the means to share information and make decisions by which improvements in productivity and quality of work life are achieved. Leadership is necessary to cause things to happen and to lend legitimacy to the importance of the productivity issues.

The United States had before it the opportunity to recreate the national consensus of purpose and action that carried us forward for over 200 years to become the world's most productive leader. We cannot assume that this will always be so unless we keep improving. We have the need—and the opportunity—to energize a new phase of growth, innovation, jobs and profits.

CASTING THE NEWS

the dalton foundries
news brief

8/10/81

SPECIAL EDITION

UNION/MANAGEMENT PHILOSOPHY STATEMENT

We, the undersigned, representing the management of The Dalton Foundries, Inc. and the leadership of Local 6805, U.S.W.A., are committed to "tearing down the wall" that has existed between us. We must work together to create new business opportunities, more jobs, and more job security. It is our objective to make our company the best in the industry.

We are dedicated and committed to a successful unified ongoing cooperative process of group participation in problem solving and decision making to make our company the best place to work for our generation and for our children. It is our objective for all employees to commit to work together for the attainment of our common goals–mutual trust, responsibility, individual dignity, self-respect, self-satisfaction and job performance by improving the quality of work life for everyone.

Jim G. Koellinger
Stephen Shaffer
Donald W. Landis
Ronald A. Koellinger
Shirrell D. Justice
Dave Greenwood
E E Krebs
Ken Davidson
C. E. Hirsch
Bill Sterner
Jerry Patterson
Wm Wicks
Russell E. DeWald
Eugene E. Laue
Donald K. Ransome
Donald E. Myers

COMPANY AND UNION ANNOUNCE JOINT COMMITMENT

Representatives of The Dalton Foundries, Inc. and the United Steelworkers Local 6805 announce a joint commitment to improve the quality of work life for all individuals employed at The Dalton Foundries, Inc. This commitment is to an approach and process commonly referred to as Quality of Work Life or simply Q.W.L.

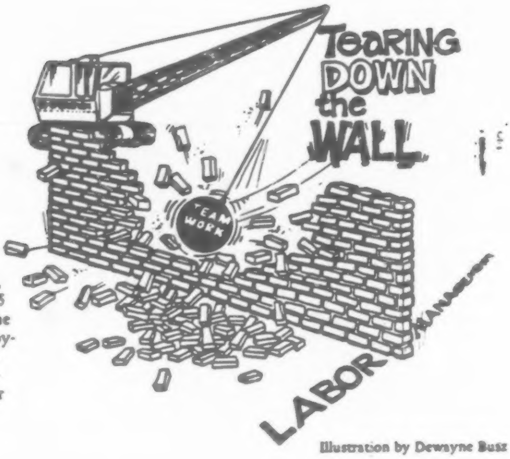


Illustration by Dewayne Busz

WHAT IS Q.W.L.?

A lot of you are probably wondering, "What is Quality of Work Life or Q.W.L.?" A definition would require considerable words and still might not cover how the phrase is used at Dalton Foundries. To some it is people appreciating other people.

In more detail, Q.W.L. simply involves people in making decisions that affect their work life, not only on goals that affect productivity and efficiency but on goals that are self-fulfilling and self-rewarding.

As Robert H. Guest put it, "'Quality of Work Life' is a generic phase that covers a person's feelings about every dimension of his work including economic rewards and benefits, security, working conditions, organizational and interpersonal relationships, and its intrinsic meaning in a person's life."

HOW DID WE GET STARTED?

The birth of the Q.W.L. process, as it is emerging today, happened over a year and a half ago. A grievance was filed pertaining to the environmental conditions in the Isocure coremaking area of the Core Department. The original problem concerned the exhaust system that takes the gases from the core box and gas leaks through the seals of the core box.

As the various members of the Core Department hourly group and management people started trying to solve the problems, they discovered help was needed from other departments such as Maintenance, Engineering and Pattern. Among those on the committee were **BARBARA BAYS, JANET CLARK, CARROLL EATON, DICK GALLENTINE, DAVE HATFIELD, BOB HOERR, RON KAUFMAN, CLIFFORD MULLINS,** and **JIM WEAVER.** As this committee formed and grew, many new ideas and solutions came forth as well as more new problems. Although not recognized at the time, the Q.W.L. process was beginning to emerge at Dalton Foundries.

The Processing Department saw a similar beginning through the Direct Line about six months later. As the first few group meetings progressed, a better understanding between union and management was established, and the same situation took place in the Processing Department that took place in the Core Department. The employees had definite feelings and thoughts on various subjects that they wanted to discuss, especially quality, attitudes, criteria changes and scheduling problems. Included in the original meetings were **LARRY BARROW, DARYL BRADFORD, PAUL GIBSON, DAN HIRSCH, RUDY REYNA, JIM RISNER, PAUL RISNER, CALVIN SEXTON, STEVE SHAFFER,** and **GEORGE WHITE.**

In both departments the hourly employees found a vehicle for expressing their thoughts and ideas. The management employees, away from the pressures of production, found the thoughts and ideas of the hourly employees extremely valuable in identifying and solving problems. These contributions from hourly employees, coupled with fresh ideas from management employees, led to the prompt solution of several mutual problems. A better way to live and work had been discovered, and Q.W.L. had taken its first tenative steps.

BUICK TRIP

After the successful meetings in the Core and Processing Departments, management and union officials started to look for help and guidance to continue progress in the process.

The result was a trip to General Motors Buick in Flint, Michigan by six management personnel consisting of **LARRY COHEN, KEN DAVIDSON, JIM KINGSTON, DON LANDIS, WAYNE NICOLA** and **JERRY PATTERSON** and six union personnel consisting of **RON HOPPAS, JIM KOEHLINGER, RON KOEHLINGER, DON RANSOME, KENNY SHEPHERD** and **EARL SNELL** on January 16, 1981.

Buick started the Q.W.L. program in their plant about five years ago. In talking to their management and union officials it was learned that this program has improved relationships between them to a point of mutual trust and understanding undreamed of several years ago.

They have some 19,000 union members, 80% of whom fully participated in their program. They have helped management get new business by participating in quoting on new jobs and then helped set up the departments doing the business to get maximum production, quality and economic results.

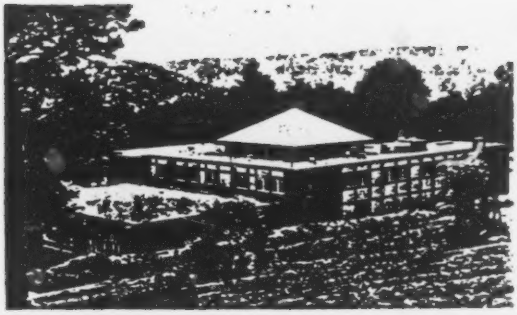
The end result was to make the Buick plant the most successful in the General Motors Division and to obtain for the union the best wages and benefits of any General Motors plant in the country.

WHAT HAPPENED AT PITTSBURGH (LINDEN HALL)?

On June 10, 1981 the union executive board and an assorted select group of management personnel met at Local 6805 Union Hall to discuss the progress and direction of Quality of Work Life at Dalton Foundries, Inc. Also present at the meeting were Dick Ault and Susan Phillips of the American Productivity Center, Houston, Texas. At this meeting it was decided that an offsite meeting to discuss future directions was the next significant step.

The site chosen was Linden Hall outside Pittsburgh, Pennsylvania. Linden Hall is the education center for leadership training of United Steelworkers of America. It was chosen by local union officers in the hope that their membership would be more understanding of a meeting held on home turf. It was dec[illegible]d that the union executive board of [illegible] HOPPAS; **JIM KOEHLINGER, RO[illegible] KOEHLINGER, DON RANSOME, STEVE SHAFFER,** and **EARL SNELL** plus two others would go to Linden Hall. The two chosen were **SHERRILL JUSTICE** and **DON MYERS**. They were chosen on the basis of departments not covered by

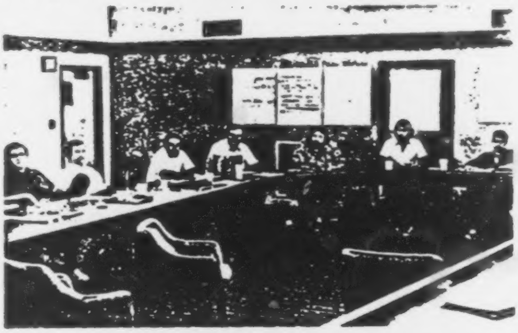
Linden Hall Mansion completed in 1913.



the executive board and the strong influence they have throughout their areas in developing the Q.W.L. process. District #30 Staff Representative Russ Dollard also attended. The members of the management group were picked basically on the same criteria. There was a variety of upper, middle and front line management from different areas of the plant. Those who went were **KEN DAVIDSON, DAVE GROENEWOUD, RON GRONAU, DAN HIRSCH, ED KREBS, DON LANDIS, JERRY PATTERSON** and **BILL STARNER.**

On Sunday, June 21, 1981 the group boarded a chartered Indiana Motor Bus and traveled a long ten hours to rural Dawson, Pennsylvania, about an hour south of Pittsburgh.

Monday saw the start of a very strenuous three-day seminar instructed by Dick Ault and Susan Phillips. They began by listing what was to be accomplished during the sessions and defined Q.W.L. Labor/management cooperation and objectives of the future were discussed. All participated in some very enlightening activities designed to promote trust and understanding, cooperation, good leadership and organization, all of which are required to develop an improved working and lasting relationship as well as a better place to work.



On Monday afternoon, **Gene Paul** discussed his visions of The Dalton Foundries of the future. He is optimistic about the future of the industry and particularly our company's role as a major factor in the foundry industry. To achieve our objectives, quality and good labor/management relations are necessary. Our quality employees provide the basis for producing the best quality products in the industry. He commented, "quality people producing a quality product with a quality of work life." Gene stated "significant progress has been made in labor/management relations and improved quality" in the past several months. He challenged everyone to reach for greater successes in the future.

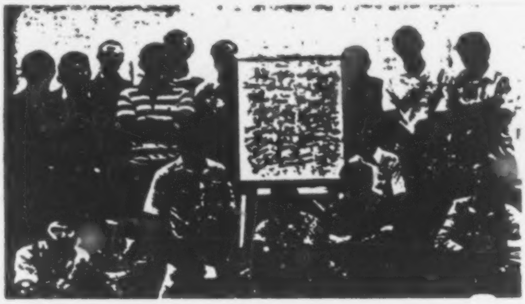
On Monday evening **George Becker**, assistant to Lynn Williams, Secretary of the International Union, spoke to the group on how the Steelworkers feel about Q.W.L. He told how his actions had helped shut down a plant where he had been a fourth generation worker. At the time he was the staff representative for the local. Because of the adverse relationship between the union and management, the plant was forced to close down. After the loss of several thousands of jobs and dues paying members George, as well as the international officers, began to realize that there had to be a better way. So they began developing Q.W.L. programs of different types just as the U.A.W. had a few years prior. The international officers now believe that Quality of Work Life is the way of the future to enhance the lives of their members and that of their members employers.

On Tuesday all participated in additional activities and discovered that management and union members share the same imaginary vision of Dalton Foundries three years from now. Also discussed were principles and practices of employee involvement as well as an assessment of the current status of Q.W.L.

On Wednesday the group made a group commitment to continue and improve the Q.W.L. process at Dalton Foundries, Inc. The commitment included "tearing down the wall," the wall being the adversity and years of struggle and confrontation between Dalton Foundries management and the members of U.S.W.A. Local 6805.

The final morning was spent planning the course of action to be followed for the future.

The long trip home was made shorter by further discussions and detailed reviews of the trip.



ORGANIZATION AND STRUCTURE OF Q.W.L. PROCESS

For the Q.W.L. process to be successful it needs to be well organized. Q.W.L. at Dalton Foundries will involve a Steering Committee consisting of six members, three members from the union and three members from management. The selected officers for the Steering Committee are: KEN DAVIDSON, SHERRILL JUSTICE, JIM KOEHLINGER, JERRY PATTERSON, EARL SNELL and BILL STARNER.

Some of the duties and responsibilities of the Steering Committee are:

1. Develop overall Q.W.L. strategy and direction.
2. Responsible for addressing major problems.
3. Provide the training and development necessary to sustain the Q.W.L. effort.
4. Acquire and allocate financial and human resources.

- In general, they are the decision makers for Q.W.L. The Committee may also appoint people to work on limited life task forces, to solve various problems or work on special assignments.

The next step in the organizational chart is the position of Co-coordinator. The persons selected for this position are DAVE GROENEWOUD and RON HOPPAS. Some of the duties of the Co-coordinators are:

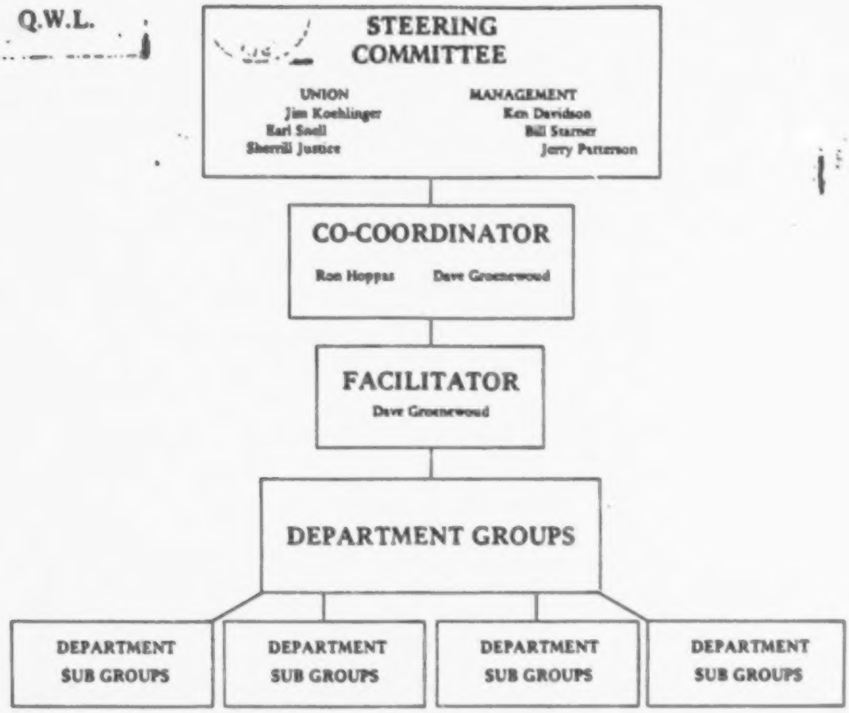
1. Implement the communication and awareness program developed by the Steering Committee.
2. The Co-coordinators are the "Q.W.L. experts."
3. The training of Facilitators.
4. Q.W.L. Ambassador.
5. Bring Q.W.L. problems to the Steering Committee.
6. Help determine and make recommendations to the Steering Committee on when and what groups are ready for Q.W.L. training.

The third step in the organizational chart is the position of the Facilitator who is actually the trainer for the program. This person will be training the group members and group leaders. He will arrange for expert advice as is needed, assist Q.W.L. groups as to: new ideas, preparing presentations, getting started, etc. The Facilitator will also:

1. Maintain detailed records of Q.W.L. groups.
2. Follow up on progress of Q.W.L. groups.
3. Maintain open lines of communication between Q.W.L. groups.

The fourth step, the departmental groups, is the most important part of Q.W.L. These groups consist of volunteers who commit themselves to making Dalton Foundries a better place to work. There can be any number of these groups in the various departments depending upon the need and interest for them. As problems arise in the department groups, special department subgroups may be developed.

Q.W.L.



"TEARING DOWN THE WALL" "TEARING DOWN THE WALL" "TEARING DOWN THE WALL"

WHAT CAN I DO TO HELP?

We are committed to Q.W.L.; it will begin to spread and grow. We would like to see each employee (hourly and management) become involved and receive training in Q.W.L. By committing ourselves to Q.W.L. we are taking a great step into the future. Through open and honest communication, Q.W.L. will better the lives of all Dalton Foundries, Inc. employees and their families.

Q.W.L. will help us improve working conditions, productivity and it will help us improve the quality of our home and work lives. It will help us feel pride in our work and ourselves.

We believe that by taking this path we will begin to see our foundry grow into the biggest and best foundry in the business, thereby improving wages, benefits, working conditions and creating many new jobs.

Anyone interested in becoming a member of the Q.W.L. team, see one of the members of the group who went to Linden Hall:

LARRY COHEN
KEN DAVIDSON
DAVE GROENEWOUD
RON GRONAU
DAN HIRSCH
RON HOPPAS
SHERRILL JUSTICE
JIM KOEHLINGER
RON KOEHLINGER
ED KREBS
DON LANDIS
DON MYERS
JERRY PATTERSON
DON RANSOME
STEVE SHAFFER
EARL SNELL
BILL STARNER

Mr. **Lundine**. Mr. Arai, would you please describe the Japan Productivity Center? What does it do in Japan and what does it do in the United States?

Mr. **Arai**. As I indicated to you, the Japan Productivity Center is the nonprofit, nongovernmental educational institution registered both in the United States and Japan as a tax-exempt organization.

It was actually founded at the recommendation of the U.S. Government back in 1955 when Japan was seriously suffering from low growth of the economy as well as frequent strikes by ideology-oriented workers. And the United States, because of the successful experiences you have had in implementing the Marshall plan for restructuring the European economy suggested to Japan that we establish a productivity center.

Mr. **Lundine**. We are having a little more difficulty figuring out a Marshall plan for our own economy.

Do you have any relationship with M.I.T.I. and if so, what is it?

Mr. **Arai**. We do not have direct relationship with M.I.T.I. [Ministry of International Trade and Industry] at all because we are a nongovernmental institution. However, an M.I.T.I. representative always sits in as an observer at our board meeting where policy formulation takes place. Also, M.I.T.I. quite often asks us to run specific projects on their behalf under contract.

Mr. **Lundine**. Now I'd like to ask you both a question if its not impertinent: What is your project and where does the money come from?

Mr. Arai.

Mr. **Arai**. Our annual budget for last few years has been about $24 million a year. The majority of our revenue comes from operations. We depend very little upon the Government support. As a matter of fact Government subsidy only represents somewhere around 2-percent, and 4 percent of our revenue actually represents fees and commissions for services rendered to the Government.

Mr. **Lundine**. To the Government?

Mr. **Arai**. To the Government. Yes.

Mr. **Lundine**. So above the 2 percent subsidy you do charge the Government some fees?

Mr. **Arai**. For the services rendered. Mostly training program we develop for Government employees——

Mr. **Lundine**. And you charge fees to private industries as well?

Mr. **Arai**. Yes, sir.

Mr. **Lundine**. And the $24 million is for your operations both in Japan and abroad?

Mr. **Arai**. Yes, sir.

Mr. **Lundine**. Mr. White.

Mr. **White**. Mr. Chairman, perhaps a little background would be in order first before getting to the budget question.

The American Productivity Center was born largely out of the dream of one man—C. Jackson Grayson—who during his stint of service in Government as wage-price guideline administrator in the Nixon administration came to the conclusion that wage-price controls were not the way to deal with our problems in this country, and recognized that productivity was of critical concern.

He went about establishing what is now the American Productivity Center largely through the levying of private subscriptions from corporations and foundations around the country to enlarge the initial effort. We really are about 4 years old, so compared to 1955 when the Japanese got started and their productivity center, we are still crawling before we learn how to walk.

Our budget has grown over the past 4 years to its current size in 1981, slightly under $6 million. Of that sum one-third, or about $2 million, comes from contributions from the private sector. There is no Government direct support to the American Productivity Center. The balance, or two-thirds, comes from self-generated revenues coming off of the programs that we are involved in.

Those programs are of an educational and training nature, seminars, training materials which have been developed, advisory services in the areas of productivity management, measurement of productivity, and more specifically the area that I was alluding to in my testimony, for which I am responsible, consulting services and work with companies and unions in joint labor/management participation activities as well as employee involvement effort.

Mr. LUNDINE. Are there any of those services or consulting fees to the Government?

Mr. WHITE. There are several Government agencies who are members of the American Productivity Center. As members they receive a stream of publications and also have the ability to tap into our information services network for research. These agencies I think contribute maybe $1,000 per year for that kind of service.

Mr. LUNDINE. So it's fair to say that $1,000 out of $6 million——

Mr. WHITE. No; because there are several agencies. I would put it maybe $10,000 would probably be close to the figure of money that's flowed in one way or another from Government agencies.

Mr. LUNDINE. Mr. Weber.

Mr. WEBER. Thank you very much, Mr. Chairman.

Mr. Arai, you have a substantially larger amount of private funding than our domestic organization does. Maybe that's just because you've been around longer, but I wonder, are there special provisions in Japan's tax code that encourage or help you in raising those corporate funds more successfully than we do here?

Mr. ARAI. Well, being a nonprofit foundation, of course, we enjoy the benefit under our special tax measure. However, most of our revenue, as I indicated, comes from our operations, just as American Productivity Center does; we do sponsor many seminars, workshops, conferences, training programs, and whatnot. We produce training films and publish textbooks and newspapers. We do offer services in the area of development of in-house training programs for corporations, both the private sector and the public sector.

We have an international business executives exchange program as well as similar programs for labor union leaders throughout the world. All these programs produce revenue for our own survival as well as expansion.

Mr. WEBER. Maybe I should put the same question a little differently to Mr. White. Are there ways in which you could see improvements in our tax law in order to help you attract funding?

Mr. WHITE. I am not sure that's the whole problem. I could talk about some ways, perhaps, to improve the tax laws that might help industry and to the extent that they helped industry they might help us more.

Mr. LUNDINE. Would you yield on that? I'd just like to ask you a specific question that has been just a glint in my eye up to this point, but suppose we just enacted a tax credit, for research and development; suppose that that was broadened to include research in improved process as well as research on product.

In other words, to be blunt about it, suppose that your consultation to companies was available for that kind of a tax credit, don't you think that more companies would probably take advantage of it?

Mr. WHITE. I think that certainly could help. As, for instance in the implementation of appendix 15 of the United Steelworkers contract with the major steel companies, there is a tremendous amount of money up front that is costing these companies to do that.

Were those investments in changing and redesigning their work relationships eligible for tax credit I think that could provide a very reasonable incentive for corporations to look more favorably at that front-end investment, particularly when there are industries such as auto, steel, the electronics industry, which are in very tough shape right now and are having to look at their investment costs very seriously.

Mr. WEBER. If I can add, just as long as we're brainstorming a little on that, I've thought of the same type of thing in a little different connection.

For small businesses that might improve their operation substantially through adaptations of computer technology, perhaps, but they don't do so because there's a lot of costs of retaining personnel and bringing in consultants, none of which can be given any favorable kind of tax treatment. If they buy a piece of equipment they can take an investment tax credit, but all of the nontangibles that they'd invest in in a real productivity improvement, efficiency improvement, and technology is not applicable.

Mr. WHITE. If I can play into that, I think you're on an excellent track, Mr. Chairman. If you look at some other countries—for instance, take the United Kingdom, which I don't hold up as a sterling example of productivity and efficiency, but for years the U.K. has had a provision for tax credits for the training of workers and the retraining of workers.

In our country we basically don't get into the business of supporting and funding retraining until people are out of work. And if there were ways in which the Government could support through a tax-credit basis the massive retraining in terms of new technology that's going to be required in a lot of our major industries, I think that that could go a long way toward getting out ahead of the problem as opposed to trying to fix it after we're already there.

Mr. WEBER. I have one additional unrelated area I'd like to talk about. I missed the testimony yesterday from the National Science Foundation, but when this subcommittee goes into the budgeting of that we spend a great deal of time discussing the efforts of NSF in terms of productivity, and I just wonder if you could comment on that if you work with them, or how you'd appraise the National Science Foundation's efforts in the productivity area.

Mr. WHITE. I have not worked that directly, so I feel inadequate to respond in a critical way. Some elements of the American Productivity Center have worked with the National Science Foundation and I think have gotten some real support and some help, and there has been some mutuality there.

I have a bit of a bias, and it plays into something that Mr. Arai mentioned earlier, if I heard him right in his testimony. And that's the difference between the improvement in productivity that has been attributed to technological breakthroughs in Japan versus the United States.

I think we are probably overly research-biased in this country, and I would like to see us spending more of our funds in basic experimental work—what I would say is much more applied work as opposed to learned papers of writing things up. I am not sure that the diffusion benefit from a lot of the learned papers that we've invested in is helping us all that much.

Certainly, and it's interesting the Ford Foundation has for a number of years been involved in supporting quality-of-work-life efforts of one kind or another. Several years ago they determined they would no longer fund research activities in the quality-of-work-life area but they would fund things such as the fostering and sponsoring of joint labor/management committees at a community base or in an industry base—the kind of funding that came through the bill, Mr. Chairman, that you were instrumental in pushing through, then through the Federal Mediation and Conciliation Service, the sum of $1 million, which in our budget terms is not an awful lot of money, but I think we can get much more bang from our buck by putting money in the hands of local people who are trying to experiment, to simply learn, as opposed to tremendous sums of money in documenting and reporting out things. That's my own bias.

Mr. **Weber**. Thank you.

I don't have any more questions, Mr. Chairman.

Mr. **Lundine**. Well, let me follow up on that one then.

Mr. Arai, do you think that the American and European larger percentage of investment in basic research to develop breakthroughs has been to the major benefit of other countries such as Japan while hurting our own interests?

Mr. **Arai**. No; I don't believe so. As a matter of fact I believe the recent survey indicated that the United States percentagewise spent just as much of its gross national product on the basic research as Germany or Japan. As a matter of fact I think you only invest about 12.3 percent, or something in that neighborhood on the basic research, and the majority of your money actually goes into the development effort rather than the technological breakthrough effort.

Germany is a country which is spending the largest sum of money—percentagewise, of course, now—of gross national product in the basic research.

True, the United States still leads the world in technological breakthrough, but in that category I may point out to you that the United Kingdom actually leads the world in technological breakthrough.

Again, it's a percentage.

Mr. **Lundine**. But we have the impression, and correct it if you will, that we are doing a lot of basic research here, perhaps the

United Kingdom is as well, and that the innovation, the actual application of that technology is taking place, and I don't mean to pick on Japan, but taking place just as much elsewhere in the world or even more so than it is here. What's your impression on that?

Mr. **Arai**. True, that many of the outstanding technological breakthroughs have been accomplished in this country, where you observe a sort of delay in transfer of technology, that is it takes the United States longer than most of the other countries in translating the technological breakthrough into the development of commercial products.

A good example, of course, is the numerical control which Massachusetts Institute of Technology developed under their contract with Navy quite some time ago.

Of the total numerical control machine tool manufacture in the world, 75 percent comes from Japan rather than the United States. So in that sense I am sure that you can say that sometime your technological breakthrough benefits other countries.

However, looked at from the global perspective, such progress in the numerical control field certainly contributes toward rapid growth of productivity of the world, which in turn aids the other country in attaining the goal of improving the standard of life of their people.

So I believe that actually in a competitive market as well as in supplementary market, the U.S. effort should be highly valued.

Mr. **Lundine**. I want to turn—Mr. White, in your prepared remarks to page 17 where you make specific recommendations. You urge us to "Support a comprehensive national productivity and quality of work life plan as outlined by the American Productivity Center," and as an appendix to your testimony you included some testimony from Jack Grayson to I think the Joint Economic Committee where he testified that we should have a national productivity program.

You get support from some of America's largest corporations. Do you think that they are willing to accept or support such a national productivity program?

Mr. **White**. I think they are, Mr. Chairman. I think that there is a great recognition on the part of both corporations and trade unions in this country that we are in deep, deep trouble, and that what we probably can no longer afford is the luxury of adversarial relationships that have existed between labor, management, and government in this country.

If we were to look for just a very simple distinction between ourselves and Japan and Germany in my view that distinction comes out quite simply as in Germany and Japan, and to a large extent listening to Mr. Jonsson's testimony in Scandinavian countries.

There is a tremendous sense of common interest between the three key elements of the economy. Yet in our country, and even, my example of Muskegon is a classic on the micra scale—we tend to each blame the other. So between management and labor there is a credibility problem in terms of trust. Between government and business there is a credibility problem in terms of trust. But as our economic situation has worsened I think the opportunities for forging a new relationship are there.

And I think a national productivity program along the lines outlined by the American Productivity Center is a possibility in this country, whereas perhaps 5 years ago it was not a possibility. I think as the pain deepens things that did not seem possible become more possible.

Mr. LUNDINE. Mr. White, you heard Mr. Jonsson describe the origins of Volvo's decision to try the new sociotechnical design. Could you from your experience at Borg- Warner describe how that company approached work reorganization.

Mr. WHITE. The basic approach was launched primarily because of the recognition of the need for a competitive advantage in the marketplace. I think at the root maybe of your question is whether legislation is helpful to that process. I suspect not. And I would probably go along with Mr. Jonsson in his statement that while legislation played a factor it probably was not the key factor.

But there was a desire to change. In Volvo I would put that desire to change right at the top of the corporation in Mr. Gyllenhammar. In Borg-Warner Corp. the chairman and chief executive officer, Jim Boray, has been a staunch proponent of what he has called the "second industrial revolution" in this country, which is basically along the lines we have talked about.

Our activities in Borg-Warner took the place of small demonstration projects in plants or divisions, and then some diffusion in learning from those activities to go further across the line.

Mr. Jonsson's testimony was very right that each plant is very distinctive, and you have to have different strokes for different folks, so I think that's part of the concern about a monolithic program that says you are going to do thus and so.

Even in the steel industry we are presently finding where there's rather specific language in appendix 15 of the steelworkers and basic steel companies' contract, the way that language has been implemented and is being implemented varies markedly from company to company and from plant to plant and from mill to mill.

And I think we have to recognize and be tolerant that this thing is going to take different forms in different places. We've got to be supportive of it overall.

Mr. LUNDINE. I couldn't agree any more, and I'd also point out that the other example of a major U.S. industry—General Motors and the United Auto Workers—take the same approach. It is not a prepackaged program that is applied uniformly.

However, you and I have a problem—I don't mean I have a problem with your testimony at all, but you use the word "plan"—productivity plan—and I'm afraid that the rhetoric is going to cause us some problem. I am not being critical of that because it's actually a fair word.

Not only do I not believe we ought to pass legislation in this country telling private industry what they ought to do in this connection because I believe that would actually retard rather than advance what we're really trying to achieve, but I want to find a way to proceed. I am encouraged by your optimism to proceed to discuss those things at a national level that make sense from the standpoint of business and labor and industry. But, in my judgment, it must be allowed to happen at the plant level, because that's the only way it can happen.

I don't even think it can happen at the local community level. If there was one thing I quickly found out in that process it was that this mayor was not going to stride into industries and tell them how they—labor and management—would better work together to improve productivity. After that long commiseration my question is, how do you think we can get across the idea that business and labor and Government at the national level can pursue common objectives without threatening people with the notion that we're going to plan their lives or that we're going to engage in some kind of a strategy that in effect dictates how they will implement a particular advancement?

Mr. WHITE. I think your caution on the word "plan" is well taken. And perhaps it grows out of our history, which I would characterize as any of the three parties I have been talking about—Government, labor or management, as we seem constantly to come forth with answers seeking problems, and to the extent that Government comes forth with answers or prescriptions for industry they are going to fall on deaf ears.

To the extent the Government becomes a partner willing to seek solutions to problems with industry I think trust begins.

I saw that happen—a very telling example—in 1967 I was living in Detroit, Mich., when the urban rebellions were sweeping across this land. And in the burning of Detroit and in the aftermath of the burning of Detroit on July 23, 1967, then Governor Romney and then Mayor Cavanaugh, in effect threw up their hands and said, we really don't know what to do, and turned to Joe Hudson and the business community and the labor community and said you've got to come together and work at this problem with us and help us solve this problem. And that was the first urban coalition that was born in Detroit.

The agency that I was with at the time happened to be working with Joe Hudson in trying to structure that first meeting that they were going to have, and it was very interesting.

Twelfth Street in Detroit was in embers and the city was in shambles, and fear was all over the place, and as the big power people of industry and labor came together in that first meeting, the first time with blacks who had been disenfranchised and were not part of that power structure at all, they each had in their inside pocket a solution to the problem.

And Walter Reuther was going to get bulldozers in there, the UAW would rebuild Twelfth Street, and Henry Ford was going to do his plan and Lynn Townsend at that time with Chrysler was going to do his plan, and we prevailed on Joe Hudson and said this meeting will only be a success if those plans remain in the inside pockets of these people, and they listened and hear other folks talking about what the problems really are and their solutions.

The same thing I'd say is true today, to the extent that any one of these parties comes with plans in their inside pocket ready to lay them on somebody else, we are going to go right back to the same old adversarial defensive relationships.

To the extent that we come together to jointly seek solutions and willing to bring what resources we can bear I am optimistic because I think my experience in this country—going back to when I was a kid and watching what happened in World War II when we were knocked back on our heels—I saw the cooperation in this country that built the arsenal of democracy.

And I guess I believe that the pain we're experiencing right now is not very dissimilar to what we were experiencing in December of 1941, and I think this country can rally together—but we all got to come to the party.

Mr. LUNDINE. And one of the tricks is to stop pointing at each other, as you pointed out earlier in these hearings. I can't recall who, but one of the witnesses used the words "limited partnership" and I like that, particularly with regard to Government. I think if business and labor could understand that Government intended only to be a limited partner not in a legal sense, of course, instead of a liability; I think we would have a lot better chance of succeeding.

And I think it's enlightening to get the testimony now from a businessman as well as official of the Productivity Center in Japan to help us understand that it is less of a limited partnership in Japan than commonly thought. We often take a conspiritorial view of your success. So that's been an enlightening factor here, too.

Mr. WHITE. Mr. Chairman, could I just add one thing to that? I think one of our great problems is, and it's probably one of our strengths, that we expect quick fixes. If you look at the story that Mr. Arai has told us and go back to 1945 and the situation that his country found itself in and then 10 years later—1955—the Japan Productivity Center got started, and they've been working all this time, very carefully with a long-term view.

We suddenly somehow feel that we can fix things overnight, and as a result I think our view is so short term. That's true of the way we evaluate our business corporations, that's true of the way Wall Street analyzes performance, and right now I see people running around this country grabbing onto quality circles and feeling that this is the thing that's going to solve us, and boy if we have 30,000 quality circles by tomorrow everything's going to be all right. I'm very alarmed at that kind of situation and I think we need to take a longer view—and culturally that's going to be difficult for us to do.

Mr. LUNDINE. I thank both of you for your testimony. I think that's a fitting end to this week's hearings.

The subcommittee will be adjourned until next Tuesday at 9 o'clock. We're going to then hear from Mr. Ronnie Stroh of the Communication Workers of America, Lloyd McBride, president of the United Steelworkers, Bert Metzger, president of the Profit Sharing Research Institute and William Koch from the Federal Aviation Administration.

Mr. WHITE. Thank you, Mr. Chairman.

[Whereupon, at 10:45 a.m., the subcommittee was adjourned.]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

TUESDAY, SEPTEMBER 15, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:12 a.m., in room 2325, Rayburn House Office Building, Hon. Stanley N. Lundine presiding.

Mr. Lundine. This meeting of the Subcommittee on Science, Research and Technology will come to order.

Today we are continuing with a series of six hearings on the subject of the human factor in innovation and productivity. Last week we held three days of hearings. The first day we heard from outside witnesses—people who were from the Government Accounting Office as well as a Japanese businessman.

We also had the testimony last week of Westinghouse officials and others regarding the innovations they are attempting to pursue.

We listened to the National Science Foundation explain its funding in economic and social sciences and the relationship of that to innovation and productivity, particularly with respect to the human factors.

We heard testimony contrasting testimonies from the head of the Japanese Productivity Center and an official of the American Productivity Center to conclude last week's hearings.

This week we are turning to some of the people who are directly participating in innovations and experiments in this area.

Today we have a couple of labor union witnesses and a couple, a Federal official and an adviser in the area of profit sharing.

These hearings come at a terribly important time when an economic program, which essentially represents a strategy for capital investment and design that affect regulation concerning technological innovation, has been adopted, but when the human factors affecting performance both nationally and within individual enterprises have perhaps not been given the attention they deserve.

The testimony we received last week surely indicated that human factors are among the most important things which will determine our destiny, not only economically but in terms of satisfaction Americans derive from their work and the quality of their working experience.

I welcome you.

Mr. Weber, do you have any comments to make?

Mr. **Weber**. No, thank you.

Mr. **Lundine**. I know that Congressman Walgren—I'm chairing these hearings, but Doug Walgren from Pennsylvania is the chairman of this subcommittee—wanted to be here, particularly to welcome the United Steelworkers witnesses. Anybody from Pittsburgh knows people in the United Steelworkers and perhaps the phenomenon of rain holding up traffic in Washington has delayed him, but I think he would want us to proceed.

This morning's first witness is Jack Sheehan, assistant to the president of the United Steelworkers. Mr. Lloyd McBride was scheduled to testify and because of strikes and other problems he has asked Mr. Sheehan to represent him, and we are very delighted to have you here. We have your testimony on behalf of Mr. McBride. It is and will be a part of the record. If you want to proceed in any less formal way you're welcome to do so.

[A biographical sketch of Mr. McBride follows.]

News from the Steelworkers

UNITED STEELWORKERS OF AMERICA, AFL-CIO·CLC
Five Gateway Center, Pittsburgh, Pa. 15222 · Phone 412-562-2666
Russ Gibbons, Director of Public Relations

Biographical Sketch of
LLOYD McBRIDE
International President
United Steelworkers of America
AFL-CIO · CLC

Lloyd McBride is the fourth International President of the United Steelworkers of America, heading the largest industrial union in North America. He has a trade union background which began with the inception of the Steelworkers more than 40 years ago, having been a member, grievance committeeman, local union officer, staff representative and district director of the union which has more than 1.4-million members in the United States and Canada.

At his inauguration at the USWA Education Center in Dawson, Pa., on June 1, 1977, Mr. McBride declared his union philosophy as one to "preserve and build the Steelworkers as an instrument of service to the membership." His commitment comes from an early experience in the workplace. He was forced to take a job at the age of 14 in St. Louis, Missouri, after his father became a victim of the Depression in the thirties. Mr. McBride was born in 1916 in Farmington, Missouri, and his family moved to St. Louis when he was four years old.

After his father was laid off in 1930, Mr. McBride went to work at the same plant (Foster Brothers Manufacturing Company) for 25 cents an hour. He was among the first at Foster Brothers to join the Steel Workers Organizing Committee (SWOC) in 1936. After the plant was organized, he served on the first negotiating committee of the newly-chartered Local 1295.

Mr. McBride was elected Local 1295 president by acclamation in 1938 at the age of 22. It was the beginning of a career that never allowed him to finish his formal education.

Mr. McBride worked as a volunteer SWOC organizer after being elected local union president. By the time he was 24, he had been elected president of the St. Louis Industrial Union Council of the CIO. That was in 1940, the same year he was named an organizer and staff representative of SWOC. He remained as president of the St. Louis Council until 1942, when he was elected president of the Missouri State CIO Industrial Union Council. He resigned to enter the Navy in 1944.

(over)

STATEMENT OF JACK SHEEHAN, ASSISTANT TO THE PRESIDENT, UNITED STEELWORKERS OF AMERICA

Mr. **Sheehan**. I thank you, Mr. Chairman.

I must first indicate that this morning we have two absentees therefore—Congressman Walgren and Lloyd McBride who was also hoping to be here, but he didn't make it either, and so I would like to have his statement entered into the record at this point.

I would like, to page through it with you and see whether that will satisfy the situation.

In the statement we indicate that as far as the Steelworkers are concerned that reindustrialization of the steel industry is a major objective both of the union and of the industry and that cooperation between labor-management and industry and Government must be of a magnitude hitherto unknown in the American economy. We don't feel we have any choices on this matter. We really feel that this rapid reindustrialization must take place.

Now productivity, quality of work life, and reindustrialization are tightly tied together. Improved productivity requires reindustrialization. But we cannot effectively reindustrialize without an improved quality of work life. There is a human dimension to the whole process and it is reassuring to find this committee addressing itself to the human factor of the reindustrialization process.

Our union represents about 1.1 million workers in a whole variety of industries, some of which are heavy ones—in steel and in nonferrous activities.

Now we have been for a number of years experimenting with the collective-bargaining procedure. We view collective-bargaining as a mechanism for problem solving—not just a system of power relationships. We're not always successful in accommodating our objectives with those of management, therefore we have some good labor-management relationships and sometimes they're poor.

We seek good wages and working conditions for our members, and we try to preserve and to create jobs so that our people can share in the good things that our society provides.

We find no fault with the profit system, provided it recognizes the rights of workers. Now it's within that kind of a context that industrial democracy in the steel plants must treat workers—not just as hired hands but represent an integral part of the production cycle.

Over the years—and I think this is interesting to note because I've seen in other cases some kind of new discovery of this—over the years the union has built a committee structure inside our steel mills with regard to safety problems, to civil rights problems, to incentive pay opportunities and to productivity arrangement. All these, as you note, have a very heavy human factor content to them.

Good communications at the plant level are fully as important as are communications at higher levels between labor and management.

Now, Mr. Chairman, in the other parts of this statement we attempt to indicate that as to steel labor productivity, it depends upon a number of factors and front up we wanted to put it in perspective. We wanted to indicate that technology, investment, modernization in the steel industry is a very key factor in labor productivity.

The statement mentions some figures. Perhaps I won't read them out this morning, but we indicate very strongly that modernization is of extreme importance if you do indeed try to increase labor productivity.

The other perspective into which we wanted to put labor productivity issues relates to is this whole question of utilization of capacity. In the steel industry over the last number of years for a variety of reasons, capacity utilization has not been maximum or consistent. Obviously we have flagged the import penetration as hurting market share within that context. But also I'd like to recognize the fact that automobile production has been coming down and construction has been coming down. What this does in the steel industry, with the type of equipment and machinery it has, is really to drive even the best productivity system right down to the ground. When utilization is lowered so as is productivity.

Now the other item on page 6 to which we make a brief reference is that the union supports a modernization program for the steel industry. I wish to take this opportunity to say that we support the continuation of the Steel Tripartite Advisory Committee which appears to remain in a state of limbo since the advent of the new administration in Washington.

A little departure here—we are talking about a working together, and there are not only two parties involved in an industry like steel, but there are three, and we had been operating under the Steel Tripartite Advisory Committee over the last 18 months. That committee, I am afraid to say, will not be reactivated.

Recent communications from the White House through the Secretary of Commerce Baldrige indicate that they do not at this time intend to reactivate the Steel Tripartite Advisory Committee where the issues that you're discussing here and which you hope we're discussing at the plant level can be and have been aired. It provided a forum for dealing with complex issues of steel industry within a broader perspective which labor, industry, and Government could bring to bear in a joint environment of dialog.

A tripartite approach in certain sectors of industry could be an important part of a national industrial policy. We see the continuation of the Steel Tripartite Advisory Committee as an essential vehicle for a much-needed national steel policy.

These brief comments on capital, technology, imports and capacity utilization in the steel industry were made simply to put the problem of productivity in the appropriate perspective. Good productivity performance relates to optimum use of resources, the technological efficiency of the industry and to the availability of capital for acquiring new technology.

Now, within the Steelworkers Union and its labor-management relationship we also have a history of trying to evolve this type of better relationship with the industry. Historically the text indicates the day after the 116-day strike in 1959 we set up what was known as the Human Relations Committee. It was a first for us, and hence it did not have a tremendous amount of success; it did come to a demise 5 years later.

In 1974 we entered into a rather unique collective-bargaining agreement known as ENA—everybody uses initials, but it's called the experimental negotiating agreement—and perhaps you might want to ask questions on that, suffice to say that it did guarantee that strikes would not occur in the steel industry given certain conditions.

In 1980, which was our last collective-bargaining agreement, we entered into another experimental operation known as the labor-management participation teams. I believe this is more relevant to the subject matter, maybe, that your committee is discussing. On page 8 the memorandum of agreement between the Steelworkers Union and the steel industry states this:

> The parties recognize that a cooperative approach between employees and supervision at the work site in a department or similar unit is essential to the solution of problems affecting them. Many problems at this level are not readily subject to resolution under existing contractual programs and practices but affect the ongoing relationships between labor and management at that level. Joint participation in solving these problems at the departmental level is an essential ingredient in any effort to improve effectiveness of the company's performance and to provide employees with a measure of involvement adding dignity and worth to their work life.

This is a signed memorandum between the two parties.

We are indicating that job-related problems are normally handled through the grievance procedure and the arbitration procedure. But there are a wide range of problems beyond grievance and negotiations requiring an effective channel of communications between workers and management that also would contribute to the efficiency of the enterprises as well as to the well-being of the workers.

One of the chief officers of the J. & L. Corporation indicated that he thought that this was something that was essential to move forward within the steel industry and at the same time not to circumvent the union in the areas where we do have contractual obligations.

The rest of the statement, Mr. Chairman, gives some specific examples, and maybe I ought not to mention them now. But it indicates where workers at the plant floor level in regard to specific conditions were able to introduce changes in the work process that did mean savings to the industry.

One of the things that we highlight was the fact that many times there was a resistance at the local, at the departmental level by foremen to workers telling them a better way of performing a particular operation. They—workers—had to move above the foreman to accomplish these gains in productivity.

The participation teams are now going to be an effort to try, in a more formal way to bridge that kind of resistance, on maybe both parties.

I would just like to close the statement by reading the last page because I think it kind of generalizes on this subject to get at the point I am making here about local plant management.

The factory culture is often an autocratic one. This has created an antagonistic work environment that often results in poor quality and restrained production. Industrial democracy in its true sense can only be accomplished in an environment free of the trappings of autocratic rule, bureaucratic redtape—and it isn't I guess only industry that has bureaucratic redtape—paternalism, and any other system of human relationships which deprive the individual of his dignity and his rights.

I think I'll close at that point.

[The prepared statement of Lloyd McBride follows:]

TESTIMONY

of

LLOYD McBRIDE, PRESIDENT
UNITED STEELWORKERS OF AMERICA

on

"Human Factor in Innovation and Productivity"

before the

Subcommittee on Science, Research and Technology
Committee on Science and Technology
U.S. House of Representatives

September 15, 1981

My name is Lloyd McBride. I am president of the United Steelworkers of America. I wish to thank the subcommittee for the opportunity to discuss with you some of our views on productivity and innovation and their impact on the well-being of working people. The topic is timely, and it is essential that we concern ourselves with the human factor if we are to have a successful program of reindustrialization in America.

One must wonder aloud whether in America we have not been managing our own economic decline. The economy of the 1970s bordered on disaster, with high rates of unemployment, high inflation, excessive imports of goods in many industries, inadequate levels of exports, and rising energy costs. For much of the decade there was a serious loss of confidence by Americans in the economy and in the society.

A re-affirmation of faith in our ability to come to grips with the social malaise that prevails in this nation is an essential task for all of us. There is little or no disagreement on the need for reindustrialization in America. It is the essential ingredient for moving ahead, for recapturing lost markets, for reinvigorating the body politic.

But stating the objective is a long way from reaching it. The kinds of changes that are required in labor-management relations must be far-reaching. And the cooperation between labor, industry, and government must be of a magnitude hitherto unknown in the American economy.

Personally, I do not think we have a choice -- given the changing nature of industry and the economic problems we face -- about seeking new motivations, better techniques for problem-solving, and more inspired efforts at reaching our objectives.

Productivity, quality of work life, and reindustrialization are inextricably related. Improved productivity requires reindustrialization. But we cannot effectively reindustrialize without an improved quality of work life. There is a human dimension to the whole process, and it is reassuring to find this committee addressing itself to the human factor in the revitalization effort.

I am privileged to represent 1.4 million workers in steel, aluminum, non-ferrous, metal can, and a host of other industries in mining, primary metals, fabricated metals, machinery and other industrial groupings. We are the largest resource-based union in America.

I represent a union with a proud history of accomplishments for our members. We have a well-earned reputation for experimentation in collective bargaining. We view collective bargaining as a mechanism for problem-solving, not just a system of power relationships. We are not always successful in accommodating our objectives with those of management. Therefore, we have some good labor-management relationships, and some poor ones. We seek good wages and working conditions for our members. And we try to preserve and to create jobs so that our people can share in the good things that our society provides.

We find no fault with the profit system, except where its relentless pursuit violates the needs and rights of workers.

We believe in a system of industrial democracy, where workers are not just hired hands, but represent an integral part of the process of production. Over the years we have built a committee structure in the plants of many of our industries to deal with problems of safety, civil rights, incentives, productivity and other issues that arise during the term of our agreements. Good communications at the plant level are fully as important as are communications at higher levels between labor and management.

Technology is not perceived by us as a threat to our jobs. Many people speak at the "global marketplace". Our industries do, in fact, have to compete with industries abroad. We seek only that the rules of the game of trade be the same for everyone. Innovation and productivity are part of our trade union lexicon, too. In a competitive environment jobs are not saved by obstructing technological innovations or by impeding productivity growth. This would be self-defeating. Jobs are protected by improving efficiency and by promoting modernization.

But it behooves each of us to be sensitive to the concerns of workers in the headlong plunge toward technology and productivity. In a declining employment industry -- such as steel -- workers view productivity as a two-edged sword. When it is accompanied by increasing demand, it can create jobs. When it is not, it means more output with fewer workers. The P&L statement and the Balance Sheet are not the workers' "bottom line" if he perceives his job to be in jeopardy. We dare not take "work" out of the "quality of work life".

Let me address myself to some of the problems of the steel industry, where approximately one-third of our membership works. It is a profitable industry, in fact among the most profitable in the world. Yet, steel is in a state of decline. Since 1977, steel capacity has dropped. Since 1974, steel productivity has seen little improvement. Raw steel output and steel shipments reached historic highs in 1973, and have been well below those highs in the years since then. Steel imports have garnered an increasing share of the domestic market in recent years, and the penetration rate of steel imports currently (2nd quarter 1981) exceed 18%.

Twenty-five years ago there were more than 570 thousand production and maintenance workers and over 110 thousand salaried workers in the steel industry. Currently there are less than 300 thousand production and maintenance workers, and salaried workers are only slightly reduced from the earlier period.

While production and maintenance employment declined in each of the last three decades, the decline was at an accelerated rate during the most recent decade. A sizable number of plant shutdowns in 1977 and again in 1979 aggravated the employment picture in steel.

Even with hindsight, there is no simple answer to the causes of steel's difficulties in the past ten to fifteen years. Inflation, imports, capital shortages, technological obsolescense, world overcapacity, subsidization of foreign steel industries, dumping, are some of the factors at work.

The rising trend of steel imports, we believe, has been an important source of our domestic steel industry problems, particularly when they have entered our market under conditions of unfair trade, and particularly when the foreign steel industries are supported by government subsidies or other forms of support. A significant portion of our increased consumption of steel in the United States has been absorbed by imports rather than domestic production.

The growth of imports has helped to keep operating rates of capacity in the domestic industry at less than optimum levels. And the effect of low operating rates is to hold productivity growth to less than potential. Steel is a high fixed cost industry, and less than optimum output becomes high cost output. Rates of return on equity are adversely affected when operating rates are low, and this in turn adversely affects cash flow.

Capital has been short in the industry. This relates directly to the productivity problem. In the 1960s when the industry spent an average of $1.6 billion per year, productivity averaged 2.9% annually. In the 1970s capital expenditures were lower in constant dollar terms, and this exacted a price in terms of productivity growth.

Productivity did grow in the first half of the 1970s (1970-74), which Don Barnett, economist for the American Iron and Steel Institute, attributes to the increased efficiency which accompanies the replacement of older technology. However, for the remainder of the 1970s, steel productivity rode a plateau. In 1980, a depressed year for domestic steel, productivity declined. Significant improvements in steel productivity in the 1980s will require substantial increases in capital expenditures on new technology.

Technological know-how does not appear to be a problem in steel. The major processes are accessible to any company or country that wants them. Well over 70 countries presently engage in the production of steel. For the domestic industry the installation of new technology has economic, not technical, constraints. It is largely a problem of capital availability. The domestic industry is behind most industrialized steel producing nations in the use of new technological processes. Continuous casting is a notable example. About 18% of domestic steel is accounted for by continuous casting, compared with an estimated 55% in Japan.

Our union supports a modernization program for steel. I wish to take this opportunity to say, too, that we support the continuation of the Steel Tripartite Advisory Committee, which appears to remain in a state of limbo since the advent of the new administration in Washington. STAC provided a forum for dealing with the complex issues of the steel industry from the broad perspective which labor, industry, and government can bring to bear. A tripartite approach in certain sectors of industry should be an important part of a national industrial policy. We see the continuation of the Steel Tripartite Committee as an essential vehicle for a much-needed national steel policy.

These few brief comments on capital, technology, and imports in the steel industry were made simply to put the problem of productivity in an appropriate perspective. Good productivity performance relates to the optimum use of resources, the technological efficiency of the industry, and to the availability of capital for acquiring new technology and improved productivity growth.

In addition to these economic considerations, the quality of the relationship between labor and management at all levels is an important factor in improving efficiency. Labor-management cooperation is at root a matter of attitude. If the parties seek conflict, they will surely get it. If they try to solve problems, they will explore and implement the mechanisms for doing so.

Steel labor and management have a long history of experimentation in problem-solving through collective bargaining. The sequence of steel strikes in the 1950s culminated in the long 116-day strike of 1959. Out of that strike emerged the Human Relations Committee (HRC). The HRC was an effort to establish a dialogue between the parties during the term of the agreements, in recognition of the growing complexities of bargaining issues. We explored the problem areas and set up subcommittees to exchange information and debate the critical issues. It was a new experience, and like all such innovations there were growing pains. Despite its abandonment in 1965 the substance of the new and growing relationship continued. The road to progress is not always smooth. That is too much to expect. Problems will always emerge. But we have learned to experiment.

Steelworker collective bargaining and economic policies are largely determined by the nature of the problems we have faced in the steel industry. Adaptation to technological change, and job losses, have influenced the direction of much of our bargaining. We have provided for intra- and inter-plant job opportunities, improvements in our grievance procedure, expedited arbitration, broadening of seniority units, early retirement, and a variety of other adjustments to deal with the impact of change. Many of these adjustments have contributed toward increased efficiency.

In 1971, we attempted to directly influence plant productivity by negotiating a provision in our steel agreements that called for plant meetings to discuss methods of improvement.

In 1974, we entered into the Experimental Negotiating Agreement in an attempt to dampen down the roller coaster cycles of production and employment that preceded and followed steel negotiations. Its intended objective, too, was an alleviation of the steel import problem. The ENA was an agreement to submit all economic issues that remained after a certain date to impartial arbitration, which was a signal to steel-consuming industries that it was unnecessary to stockpile steel in anticipation of a strike. Its intended impact on productivity was to avoid the inefficiency of peak operations which preceded the contract termination date and the equally inefficient operations at the trough following the contract settlement.

In 1980, we engaged in another experimental effort, this time to directly involve workers in the plant, at the departmental or unit level, to discuss and deal with a full range of problems and possible solutions which are not addressed directly by the language of the agreement between the parties. In the Memorandum of Understanding on Labor-Management Participation Teams it is observed that:

> The parties recognize that a cooperative approach between employees and supervision at the work site in a department or similar unit is essential to the solution of problems affecting them. Many problems at this level are not readily subject to resolution under existing contractual programs and practices, but affect the ongoing relationships between labor and management at that level. Joint participation in solving these problems at the departmental level is an essential ingredient in any effort to improve the

> effectiveness of the company's performance and to provide employees with a measure of involvement adding dignity and worth to their work life.

Job-related problems are normally dealt with through the grievance procedure and through contract negotiations. But there are a wide range of problems beyond grievance or negotiations requiring an effective channel of communications between workers and management that can contribute to the efficiency of the enterprise and the well-being of the workers.

The Participation Teams mark the beginning of an increased involvement for employees in their work and their work environment. It is a tribute to the recognition that workers are more than "hired hands" to be assigned a task like an automaton. In many respects they are more knowledgeable about manufacturing processes, the uses of equipment, and the quality of production than their managerial counterparts. Workers are a source of expertise that managers have by and large failed to utilize. This is changing in the steel industry. Thomas Graham, President of J&L Steel Corp., stated his company's objective for Participation Teams:

> We want to encourage an open dialogue among employees and managers that will draw out new ideas. We want to give all employees the sense of personal involvement that can lead to more dedicated and effective effort.

This effort is being made with the full cooperation and support of the International Union. It is not an effort to circumvent the union. Recognition of the potential contribution that workers can make to the solution of plant and production problems is, I believe, a significant departure from traditional management attitudes in steel that bodes well for the future.

Several major steel companies, in concert with the union, have set up Participation Teams and more are expected to do so in the near future. Because of the short time they have been in existence, our experience with the Teams is limited. However, some preliminary successes are already evident. Let me give you a couple of examples.

The Participation Team recently established in a blast furnace cast unit of a major steel producer suggested that management install a tool shed with proper tooling on each casting platform in the unit. For years prior to the formation of the Team the suggestion was periodically made. And for years the foreman's response was negative, and with the further caveat that "it's just more tools to destroy or steal". As a repository for tools, the shed would provide the advantage of ready accessibility. This, the employees, said, would substantially eliminate delays involved in searching for the appropriate tools when they were needed. The shed was erected at a cost of $12,000, and by its own reckoning the company has estimated that there will be a savings of $320,000 per year -- simply by the elimination of casting delays.

In the Finishing Unit of a Billet Mill in another major steel producer the Scarfers were unable to remove all of the surface defects on the 4x4 billets that flowed across the cooling and scarfing beds. The problem was that the steel plates on which the billets rode across the bed buckled at the edges, due in part to the heat of the billets and in part to the heat of the scarfing torches. The buckling of the plate edges made it difficult for the Wrencher to turn the billet in order to smooth the surface on the unturned side.

The solution seemed simple enough. Thicker steel plates were needed in order to resist buckling under the intense heat. The labor Team suggested this be done during the shutdown period so that production would not be interrupted. The first-line foreman resisted the suggestion because of company policy on limiting maintenance hours and because Burners and Welders, who were needed to remove and replace the plates, were scheduled off.

In this instance, the labor Team circumvented the foreman and put the problem before the department superintendent. When the superintendent was made aware that billets were passing through with surface defects, he ordered that all the scheduling arrangements be made to get the plates replaced.

An additional problem was one involving new high pressure oxygen and acetylene torches purchased by the company for scarfing. Highly sensitive controls made it difficult to eliminate the surface defects without gouging out indentations in the surface of the billet. The employees hid their old torches and used them when supervision was out of sight. They were less efficient, but did less damage to the billets. The problem was discussed and it was agreed that new torches would be ordered, but only after being tested by the Scarfers and determined by them to be appropriate.

Additional problems involving bent billets and defective wrenches are being dealt with. The improved quality, elimination of scrap, and increased production which is expected to result from all of the changes are expected to save the company literally millions of dollars.

Resistance to change is as normal a condition of life as change itself. It affects managerial personnel as well as production employees. Workers at all levels will cotton to participation so long as they do not perceive such involvement as jeopardizing their job and their livelihood.

The factory culture is often an autocratic one. This has created an antagonistic work environment that often results in poor quality and restrained production. Industrial democracy in its true sense can only be accomplished in an environment free of the trappings of autocratic rule, bureacratic red tape, paternalism, or any system of human relationships which deprive the individual of his dignity and his rights.

We are enthusiastic about the prospects for Participation Teams. If successful, they will make a difference. The Teams are not a panacea for the ills of the domestic steel industry; but they are an important part of any overall strategy for revitalizing this basic industry in the United States.

Mr. LUNDINE. I want to thank you for your testimony. I think that the steel industry and the steel unions are to be commended for recognizing first the need for collective-bargaining stability in an industry that was previously seriously impacted by strikes. In my judgment you're also to be commended for recognizing the same need for stability noncontractual issues, where it requires some greater degree of worker participation.

You said that you were going to skip over the examples, but I want to encourage you to get into some. What I am most interested in, recognizing that the whole worker, labor-management participation team agreement you came to is rather new, is if you are in a position to evaluate it in any way? I mean, do the steel workers still look at it enthusiastically? And second, can you give us the benefit of any specific experiences that sort of point up the reason for your confidence or your lack of it?

Mr. SHEEHAN. We are not in the position right now to give an evaluation of it, as I understand the situation. The participation teams have only come into play last year. It is the intent of the union and the industry not to push these participation teams at all of the plants. They're picking specific plants where they feel they have a chance to succeed.

Mr. LUNDINE. Excuse me. In other words, it's more or less voluntary with the local union and the local management?

Mr. SHEEHAN. Exactly right, and if I might make a contrast, a number of years ago we had the called productivity team. Well workers don't like the term "productivity teams" because of past connotations.

Another defect with the productivity teams was the effort to impose them from top on down—from top union leadership, from top management leadership, and push them out into all of the plants and universally have these teams at all of the plants. That kind of an approach did not result in any of the plans effectively working.

So this time they not only changed the name but they said it would have to come from the bottom up and they would be very selective as to where they would really try to promote and push it.

At this point it's in the selectivity stage. There are a couple of the plants that have these in process and maybe the examples which you asked—I don't know whether I should give them to you now—may be indicative at least of that aspect of their operation that dealt strictly with productivity factors.

Mr. LUNDINE. I noticed at one point on page 11 of your testimony, you gave an example of an idea that had come from workers. I was struck by the sentence, "The solution seemed simple enough." And one of the intriguing things about this kind of participation of workers in improving the production process is how often they are able to come up with simple ideas, that no one necessarily means as criticism of management. I was interested that in a couple of your examples you gave instances where workers came forward with fairly simple solutions which were very apparent to them because they were involved in the particular process.

Mr. SHEEHAN. It's interesting that you pick that example because it gives me an opportunity to mention that the problem was recognizing the difficulties that each party had at that time. Not only the workers who, let's say, had the simple solution, but local foremen who also had a problem, and I think the key sentence in that example—well, the example was one in which they move what is known as billets across a table or a platform, and for the purpose of our discussion it had buckled because the steel on this table was very hot with a lot of heat moving across it. The process through which they were working on these billets required additional heat. So the ends of these tables would buckle up. When the workers tried to move very heavy objects around this very buckled table, the movement activity proved very different.

The solution was to remove those thin steel plates and put thicker plates in.

Mr. LUNDINE. OK.

Mr. SHEEHAN. That was the solution. It seemed obvious; you move easier on a flat surface than on a buckled surface. But now note in that second paragraph, it says, "The firstline foreman resisted the suggestion because of company policy of limiting maintenance hours and because the Burners and Welders, who were needed to remove and replace the plates, were scheduled off."

Now, you see the foreman had a problem. He's responsible for production, he's also watching his ratio of down time and maintenance time to production time. The more he has of maintenance time the less he has of production time. So he's concerned about having too high a ratio of maintenance to production in this particular case, and so he said, "Well, look, fellows, you're going to knock me out of the box because I'll have to shut this down, I'll have to bring in these additional maintenance people, I don't need to do it here, the production is moving here—it may not be moving efficiently but I have to maintain my own responsibilities and my own record."

And so there was a clash. In this case they went above the foreman, to the department's superintendent.

Now maybe the participation teams will help try to resolve the conflicting responsibilities so that we each understand one another's problems. I think this is what you're mentioning, Mr. Chairman.

Mr. LUNDINE. That's an excellent illustration that not only labor has to voluntarily commit to this kind of a process, but management at all levels has to pretty voluntarily commit. In other words, you have to have the foreman interested in the program or he's going to resist, and yet you have to have other levels of management because it may be things to correct the problem or to improve the process, it may be things that the foreman does not have authority to implement.

Mr. SHEEHAN. You're exactly right.

Mr. LUNDINE. It's a very interesting point. For the benefit of the other members I have other questions, but I'm going to pass it along. First of all, to recognize Doug Walgren, the chairman of the subcommittee.

Mr. WALGREN. Thank you very much.

Mr. Chairman, at the outset all these hearings, it's only appropriate to recognize Mr. Lundine's interest and driving force in this area. The subcommittee also is very interested in what can be developed in this area. There is no other more important area for the country as a whole; so although this may become redundant after awhile, you deserve a lot of recognition for what you are doing.

It seems obvious that this problem contains two elements: First, is that both sides understand each other's problems and the second is an organizational element of trying to develop a flow of communication within an organization, between each level, that is broad enough to develop the best solution to the problem.

In other days we've had witnesses saying that management is now being criticized for taking a very short-term view. In this case the foreman in a sense was taking a short-term view. He was saying his own goals were close enough on the horizon that he would choose to pursue them rather than relate to the overall goals of the larger production stream. And the problem is really one of developing contact through an organizational structure that will look the farthest down the road—to the overall production potential; is that off the mark?

Mr. SHEEHAN. No; I would say, Congressman, that what you're saying is correct if there is some kind of a—if you wish—institutional system or procedure whereby you not only recognize the problem you're trying to overcome but try to recognize the opportunities and the limitations of the people that are going to apply a solution to it.

In this case. We recognized that the foreman had a problem that was a real one for him. And how do you get the system to recognize his problem, too?

Maybe this is where the participation teams—will help jump the problems or the limitations each party has to come up with a solution to the productivity problem, if you wish.

I can't help but inject at this point that—and I had mentioned earlier—that we have a number of committees that are operating in the plants right now, not the least of which, but the newest of which, of course, is the labor-management participation team.

Take for instance this whole issue of occupational safety in the plant. This involves a human relation in the plant, and there's a whole hierarchy of obstacles that sometimes prevent one party or the other from advancing and changing the quality of worklife in the plant. The the participation teams might be able to try and handle some of these issues, too.

Mr. WALGREN. And to the degree that those needs are not kept current then Government tends sometimes to get involved as with the Occupational Safety and Health Administration or something similar. We spin a lot of wheels on that level and create resistance in management because they may be opposed to Government playing some particular role. But yet isn't it partly in answer to the lack of organized communication effective in solving a safety problem, that OSHA came about?

Mr. SHEEHAN. Well, I'd like to say that the Government role in mass industries like steel is not just an intrusion role. I mentioned earlier the Steel Tripartite Advisory Committee which we looked upon as a very productive operation because it had Government as one of the three parties. Currently we are being informed that the administration will not reactivate the Steel Tripartite Advisory Committee.

Now again my reason for mentioning it is that Government can be very positive in helping the systems inside the plants to operate. Obviously when Government comes in with let's say tax policies that are designed to try to induce modernization in steel mills, for instance, I look upon that as a positive effort to create an atmosphere where productivity—labor productivity if you wish—can advance.

I look upon OSHA, I look upon EPA, for instance, as creating an atmosphere in which you can get a positive response from management to do these quality-of-life factors.

Now I guess someone could say well, if they had done them all along you wouldn't need Government's role in creating this atmosphere, but we are dealing with very massive industries and we're dealing with all these structural problems inside a very large operation. And it does need outside—if you wish—and inside involvement to try and handle this thing.

I think the union itself, in a way, is coming from the outside in. You need these because the industrial institutions, say a large steel mill, is so large that you need many parties to work the complex problems. One cannot just say well, "They (individual workers) could have handled it completely voluntarily on their own."

It's creating an atmosphere. Collective bargaining in this case is creating an atmosphere; namely, the participation teams.

OSHA is creating an atmosphere; namely, the idea of inspection of plants.

And I must say that with regard to OSHA being inside the plants, it's done a lot for the companies to operate now on a voluntary basis.

Mr. **Walgren**. There are so many types of contributions that the Government can make, and I think the mere presence of an outside independent judgment is sometimes important between two parties to sort of draw out a greater reach within each of the two parties for some kind of understanding of the other's position.

And I would think that in some instances that outside force should have the power to make decisions and act as an independent arbitrator or something similar.

But there's another role of Government in that it controls a great deal of the outside influence on a steel mill and the steel industry, particularly the flow of imports and the economic climate that the company operates in.

Why do you think the administration is showing signs of moving away from an ongoing Tripartite Commission that could bring what we have seen as a truly beneficial result, at least with respect to the steel stretchout environmental laws?

Mr. **Sheehan**. Well, the reason that was given in a letter from Secretary of Commerce Baldrige to Congressman Gaydos with the House steel caucus was that the administration did not see a need at this time to reactivate the committee because ongoing talks with the industry were satisfactory.

I might interpolate here, you see it's again, that we're talking about three parties involved in steel industry problems, but the administrators knock off one party; namely the union so the relationship may be "satisfactory."

Mr. **Walgren**. The question is, satisfactory to whom?

Mr. Chairman, perhaps we could at this point in the record include a copy of that letter—I'm sure it's a public document—and it might make interesting background.

Mr. LUNDINE. Without objection, we will request a copy of the letter from Secretary Baldrige to Congressman Gaydos and include it at this point in the record if it's available.

Mr. WALGREN. I'd just like to repeat the question is: Eliminating a party would be satisfactory to whom? This is the whole point of creating organizations that reach across parties that may have different interests: To try to reach a satisfactory agreement to both and not only to one. To the degree our organizations limit us from creating that kind of broad-based satisfaction with our working arrangements we are going to suffer in terms of productivity.

Mr. SHEEHAN. If top management and top union ignored local union officers and foremen—you're just not going to get the result of a freer flow and "voluntary"—if you wish—operation, because they're being ignored. Plant floor problems are being ignored while top management is only looking at trying to drive through a solution and not looking at the tools that each of these two parties at the local level have at their disposal.

I think that that's the key in this example, and I am glad that Congressman Lundine flagged. The example dramatized one of the problems in the plant which is that sometimes the hands of local workers being tied—in this case the foreman.

Mr. LUNDINE. If the gentleman will yield, I was going to raise that in a second round of questions, and I must say I am very deeply concerned about the decision of the administration not to proceed with the Steel Industry Tripartite Advisory Committee. Looking at the environmental stretchout for example, here is an area that you had a lot of competing interests, and it wasn't just big government, big steel, and big labor that sat down and came to a solution. In fact the environmentalists either were brought in or were somehow consulted, and when this legislation went through the House of Representatives my recollection is that it passed something like 393 to 12 or something similar. Was it 3?

So here you had a very controversial matter that critically affected an industry that is alleged to have worldwide overcapacity. It is alleged that foreign countries are actually subsidizing their steel industries. The response here is creative.

Now most of these hearings are targeted at the workplace. But it seems to me, and I gather from your testimony you would agree, that it seems to the steelworkers that factors which can only be determined at sort of a national level between labor and business and Government can impact on that very workplace in such a way that it would be useful to have that kind of dialog.

Mr. SHEEHAN. I might elaborate a little bit more on that to this extent. I believe because of the Steel Tripartite Advisory Committee [Star] and the contact in the public forum that the union and the industry has had with regard to modernization of the steel facilities there has been created a reception on the part of our members about the absolute need to accelerate modernization in the steel industry. For steelworkers at plants throughout this country—you don't have to give them a speech about the idea to bring about this capital modernization in our steel mills.

Now the reason I am mentioning that is because, you know, some years ago modernization sounded like automation, and automation meant a loss of jobs. The idea of job security seemed to be inconsistent with modernization.

I think that these forums under Star that operated outside the strictly collective bargaining table created the atmosphere, if you wish, the cooperation, or at least the understanding of the needs of the industry or the acknowledgment of this idea that we need to accelerate that modernization.

We're convinced that modernization is necessary in the steel industry and I think it was because of the articulation constantly in this kind of a public forum that created that acceptance.

Mr. **Lundine**. I think that's an extremely important point.

Last week in contrasting the Japanese situation to our own one of the big factors brought out as a positive worker attitude factor affecting productivity was job security—not surprisingly.

And here steel unions are testifying to us that you have come to the conclusion—at least by seeing the down side of not modernizing—that you want improved technology and yet you feel as though you're not being given all of the opportunity to enter into a dialog that might advance that. Even in an era when I think it's correct to state that probably in steel are technologically behind the Japanese, if not others. In terms of how many continuous casting processes you have in mills, for example. Is that not true?

Mr. **Sheehan**. That is true.

Mr. **Lundine**. Excuse the intrusion, but I thought it fit right in that place.

Mr. Brown, do you have a question?

Mr. **Brown**. No.

Mr. **Lundine**. Mr. Skeen, do you have a question?

Mr. **Skeen**. I have no questions.

Mr. **Lundine**. I just want to ask one followup question.

We have heard testimony that the impact of technology on the workplace is an area that has to be assessed from the standpoint of the individual worker. I guess a question I have is, do you envision these labor-management participation teams being involved somehow in the introduction, hopefully, of new technology into the steel mill?

Mr. **Sheehan**. I would think, Mr. Chairman, that the initial work or activity of these committees will relate more to situations that are already in the plants and will not rise, in the immediate future, to a real discussion of the introduction of new technology into these facilities. I don't think at this point we're ready for that kind of a task—and mostly because as I indicated earlier—these committees are still on a very selective basis and they are dealing with very immediate, hands-on problems.

The issue as to changes in processes may not yet be a task that the committees can grab ahold of. I, however—you know, like everything else—have to throw some caveats in there. When we were undergoing the process of trying to establish under OSHA, a coke oven safety standard because of the coal tar pitch volatiles that are carcinogenic to workers in the coke ovens, we did as a union and as an industry in the forum of an OSHA rulemaking procedure, discuss a great deal the new technology in coking.

So to some extent we've made some reachings into that area, but I would say right now it's going to be the hands-on contact with the immediate problems that are in front of us. But let me, without being too repetitive jump back to that Steel Tripartite Advisory Committee. One of the working groups that we had established with three—union, government, and labor—was a working committee on research and development.

We issued a report, as a matter of fact, trying to identify where the new technology might be in steel, to what extent it should be introduced, is the steel industry technology hungry? I mean, are they technology poor?

Putting some perspective on that issue, the industry and the Star stated at that time that there isn't a lack of knowledge of new technology. It isn't being put in because of other factors.

The point I want to make is that this report was part of an overall discussion that might eventually, like the discussion on the need to modernize in the steel industry, bring about an atmosphere of understanding at our plant level when we focus on the rather detailed aspect of new technology. As the information moves up and down our communication system we create, I think, an ability for the participation committees to engage in that operation. But right now, I don't think so.

Mr. LUNDINE. Are there any other questions?

I'd like to thank you very much.

Did you have something else you wanted to say?

Mr. SKEEN. If I might.

Mr. LUNDINE. Surely.

Mr. SKEEN. In connection with this Mr. Sheehan, concerning the tripartite teams that you had, what, specifically, do you envision as the Federal Government's role in this?

Mr. SHEEHAN. The teams I was making reference to was the Steel Tripartite Advisory Committee, which was one part of a communication system. The other was the participation teams.

The participation teams are strictly labor and management at the local plant level, handling problems in the plant outside of the quasi-judicial grievance procedure. The problems are being handled locally, and Government at that level, regarding those problems, has no direct——

Mr. SKEEN. Had no part in the participation teams?

Mr. SHEEHAN. No part in the participation teams.

Mr. SKEEN. But in the Advisory——

Mr. SHEEHAN. But in the Advisory it was the third party—this was the labor, there was management and Government—and the interesting thing about it, it was Government from the various departments—the Labor Department, the Commerce Department, the STR, and the Environmental Protection Agency.

I think the unique thing there, as it is at the participation team level, was that each party was trying to understand what the Government mission is. I mean the Government people can't just roll over and play dead. They've got laws to implement, and they've got the public good to defend. Yet at the same time there were some industry and—if you wish—union problems, and the idea was, how could you coordinate these various Government policies which sometimes, it might be said, are conflicting.

The relationship of let's say the Commerce Department's concern for an export market, and the STR's concern with imports. How did you mold these issues together and try to take a look at the public policy responsibility of all these Government agencies as they impinged upon the steel industry?

I think through Star the Government was able to say, well, what's your problem?

Do you know when the Government finds out the problems in the steel industry? It finds out after a company shuts down a steel mill and you get a couple thousand steelworkers banging on the gates down at the White House. That's too late.

I think the Government was saying: Well, look, can't we find out the emerging of these problems before you shut down a big, major facility? What are the public policy aspects of that situation that might help alleviate this problem, or help move forward so that we can protect the jobs and protect the industry and the country?

That was the key role in this process—it was a very key role.

Mr. **Skeen**. Mr. Sheehan, I appreciate you making the distinction between the participation teams and the Advisory Committee and at what level they operate. How was this process carried on as far as the Steel Tripartite Advisory Committee groups? In other words, when the problems were aware to the two segments, were the effective Government agencies invited into the discussions, or was this an ongoing thing in which it was left wide open to whatever Government agencies were affected?

Mr. **Sheehan**. Well, first off I probably should say that the typical labor-management disputes or problems which we generally refer to as age contract issues, were not the subject matter of the Steel Tripartite Advisory Committee. The subject matter of the Steel Tripartite Advisory Committee were more the public policy aspects of the Government with the industry and its workers.

Case in point. If there is a plant shutdown what are the adjustment or readjustment programs of Government? We're talking about both the aids from the private sector and the Federal Government and its various agencies because these programs administered sometimes by Commerce, sometimes by Labor, and some by STR. Then you have different aids that Government might offer through the Economic Development Administration. So in that example it was the public policy aspects of plant shutdown and readjustment policies.

At other times it was the public policy aspect of a tax system that did it or did it not induce capital formation?

Incidentally on that one issue, we weren't going to say: "Well look, give the industry everything, or give the workers everything they wish. But what were the actual capital needs of this industry? Was there a target that this industry needed to reach in terms of investment in new plant and equipment?

And so we discussed—we really tried to put a stethoscope on the industry as to how obsolete it is. What was the rate of turnover of these productive facilities? For instance, we discussed the fact that the steel industry turns over its facilities every 50 years, whereas some of our competitors turn over their steel mills every 20 or 25 years.

Well, you know, modernization has a tremendous impact on productivity and labor productivity. So we discussed that. We discussed the trade policies, for instance. And we discussed the Environmental Protection policies. I thought we evolved a strategy as to how Government, in a more coordinated way, could address what was at that point perceived to be "the steel crisis." Now we have a new tax program in place, we have the environmental stretchout for steel, we have the trigger price mechanism to stop dumped imports. Recently the industry announced investment this year of over $5 billion in new plant and equipment. Well I think the public forum ought now to be aware of whether we're all living up to our commitments. Tripartite committee was that forum for accountability.

Mr. SKEEN. Thank you, Mr. Chairman. That was the concern that I had. The question wasn't related to management-labor problems as such, but problems with the industry as a whole, and how current and how frequent those were. The Federal Government was a party to the problem before it became severe, and I was trying to understand what type of ongoing program it was, and how close and with what regularity the Government was monitoring.

Mr. SHEEHAN. Yes. I will say just in terms of the chronology, for instance on the environmental stretchout there was a working committee on that and the environmental problems of the steel industry.

I must say that we met all told—both at kind of like a subcommittee level and at the full committee level—I would say just on that issue we must have met maybe about 15 times.

Mr. SKEEN. Within a year?

Mr. SHEEHAN. Within an 18-month period.

With regard to capital formation and the modernization needs in the industry we must have met almost double that.

The full committee itself which had the top officers of the steel industry, top officers of the Steelworkers Union, and Cabinet-level officers—we met at that level within that year, I think maybe about four times, reviewing the papers that had been moved through those subcommittee channels, so we had many meetings at the subcommittee levels—many meetings to try to focus on those various aspects of the steel industry.

Mr. SKEEN. So it was very current and ongoing?

Mr. SHEEHAN. It was very current and very ongoing.

Mr. SKEEN. Thank you, Mr. Chairman.

Mr. WALGREN. Will the gentleman yield?

There is one thing that I think deserves to be pointed out and that is the potential of this kind of interaction in terms of pulling all the parties up by their bootstraps to do more to satisfy the needs of the other side. To my knowledge, it is the only time in the U.S. history that an industry has committed to reinvest its profits or a certain amount of money back in that same industry.

One of our problems is that management takes its capital and invests it wherever it may get the most immediate return and oftentimes that's in Disneyland or Montgomery Wards. For the first time in history management committed itself to reinvest in that particular industry. And that is an incredible, or, at the very least, a very new ground that was broken.

And it was broken because Government was a party in these conversations and each party then had to reach down farther to seek the understanding of the other parties at the table.

That's why it seems such a shame that we're moving away from that and going back to a viewpoint well, where it's just little chits of dollars that we're moving around. Somehow it happens without regard to the human interaction at all. The fact of it is the most constructive things are largely dependent on the human interaction involved.

Mr. **SHEEHAN**. Additionally I might note that this tripartite committee was meeting at the same time that our Government was in a similar but international kind of a forum with other governments under the auspices of the OECD—Organization of Economic Cooperation and Development—in Paris. There is a special OECD Steel Committee, and all of the steel-producing countries are meeting in that forum. Its delegates are comprised of exclusively Government people, though—discussing steel problems. But even there we have a subcommittee delegation made up of three parties.

Mr. **SKEEN**. Thank you, Mr. Chairman.

Mr. Sheehan, I appreciate very much you illuminating my viewpoint as to the workings of the committee, and I concur with my colleague that I'd rather see us dealing with the problems before they become severe rather than trying to do something after they have reached a critical level where you have to reconstruct something. And I think it's a mistake to let this thing drift off and not have that kind of input into an industry as important to us as the steel industry.

Thank you.

Mr. **LUNDINE**. Thank you very much, Mr. Sheehan.

Mr. **LUNDINE**. The next witness will be Mr. Ronnie Straw, director of development and research of the Communications Workers of America.

I think it's particularly appropriate that we have two labor witnesses this morning—one, a representative of heavy industry and the particular needs of probably the most crucial heavy industry in America, and another a representative of a more sophisticated technology—the communications industry—which is significantly different.

Mr. Straw, we have your written testimony. It will be made in its entirety a part of the record. You may proceed as you like.

STATEMENT OF RONNIE J. STRAW, DIRECTOR, DEVELOPMENT AND RESEARCH DEPARTMENT, COMMUNICATIONS WORKERS OF AMERICA

Mr. **STRAW**. Thank you, Stanley. I enjoyed meeting you at Toronto, Canada, and I hope that you enjoyed the meeting there on quality of work life.

I know that the high point of the meeting when I was there was that W. C. Button who was one of our district vice presidents and Michael Maccoby who is head of the Harvard project on technology work and character and I had an opportunity to meet with Polish labor leaders from Solidarity. And while we only had the opportunity to stay an hour with them because I had to leave to give a speech it amazed me the interest of the Polish labor leaders in the work of participation projects going on in the United States.

You see, they haven't had any of those for years, and they spent approximately 3 hours just talking about what we were doing in the Communications Workers, and their interest was just amazing.

Mr. **Lundine**. Well, as difficult as our communications may be between Government and labor and business in this country and as much as these hearings may be bringing it out, it's useful to remember that in the Communist countries that type of communication is virtually nil. I likewise appreciated that opportunity at that international conference, not only to have some side conversations with people like the Communications Workers and the Bell System people who were there, but also with the people who were really struggling representatives of Solidarity.

Please proceed.

Mr. **Straw**. Yes. I know that—just to comment one bit further—I know my personal opinion and I look at the United States and look how people feel toward their environment—I feel that we are most concerned about crime on the streets, but when you look at the Communist countries and listen to what people have to say, you know, they fear their government, whereas in this country we don't necessarily fear our Government.

At any rate, I am happy to be here. My name is Ronnie Straw, and I am the director of the development and research department of the Communications Workers of America. Seated on my right is Lorel Foged who is the senior economist of CWA, and she is the person who was responsible for our study on productivity, which I will be referring to in my report.

I will give you a short version of my report instead of the version which was submitted for the record.

Mr. **Lundine**. We appreciate that.

Mr. **Straw**. We represent over 600,000 workers and administer in excess of 700 contracts in the telecommunications industry, which as you know has been characterized by rapid technological change over the years.

We also represent over 60,000 workers in the public sector and other industries.

Today I would like to discuss with you our union's experience and special knowledge of the impact of technological change on workers at the A.T. & T.

I want to compliment this subcommittee for holding hearings on a subject that will grow in importance as we move in the microelectronic age, and I would also like to compliment Congressman Lundine for his pioneering legislative efforts in the area of labor-management cooperation.

In recent years many American workers in a variety of jobs have observed first-hand the rapid introduction of new technology into the workplace. Today technological development reaches far beyond the workplace and affects everyone—both at work and at home.

New technology can provide a host of benefits to our Nation. Decreased costs and improved productivity that results from technological change can supply a much-needed boost to our lagging economy. New technology can lead to our improved standard of living, enabling us to enjoy a greater number of improved products and services.

Technology can bring us everything from time-saving gadgets for the home to life-saving medical devices and can even prevent the world from running out of energy and natural resources.

In the workplace developments in technology can improve working conditions and open up new jobs.

But our eagerness to reap the benefits of technological change should not blind us from its possible costs. Businesses generally promote new technology in a short-sighted attempt to decrease costs, paying little attention to the human effects of innovation.

Advancements in technology can have strongly adverse effects on workers by reducing skill requirements, eliminating jobs, fostering mental and physical stress, creating health and safety problems, and fracturing jobs.

Workers are heavily monitored and controlled by management and by machines—causing a dehumanization of the workplace. Employees begin to feel like mere appendages to the machine, and not like individuals.

These adverse effects of technology can be so overwhelming as to negate any of the desirable benefits.

To illustrate this point let me describe to you the study we conducted at CWA.

Prior to negotiating a national agreement with the Bell System in 1980 CWA engaged a noted economist and productivity expert to study labor's contribution to productivity in the Bell System.

Productivity has been growing at an accelerating rate for years in the Bell System, averaging a growth rate of over 7 percent per year in the 1970's compared to barely over 1 percent for the total private U.S. economy.

The Bell System has consistently contended that this rapid growth has been due to technology. Our study, however, showed that economies of scale and not technology have caused the high productivity growth, and labor has made a substantial contribution to this growth—approximately one third.

We found that as new technology had been introduced into the Bell System over the years the effect has been sometimes to decrease costs, and sometimes to increase costs. The net effect over the period we studied—1947 to 1978—has been just about zero. Thus, technological change in itself at the Bell System has had no substantive role in the industry's high productivity growth. Instead, it is the hard work of labor, together with other inputs, that have enabled the Bell System to take advantage of increasing returns to scale and achieve high productivity.

Apparently this unfortunate outcome of technology arose because the Bell System introduced new technology into the workplace with no regard for human needs.

Because labor and capital work together in fixed proportions in the Bell System any rapid change in technology would upset this balance and have a negative effect on productivity. At times the disruption actually caused costs to rise.

In the long run these setbacks canceled out any benefits that might have accrued from the new technology.

Does this mean that attempts to increase productivity through technological change are in vain? Absolutely not. We at CWA believe that society can achieve the benefits of innovation without sacrificing human needs, but the only way to insure that this will occur is to provide for effective worker involvement in all aspects of technological process—from inception, through implementation, and finally, replacement.

In the past decade our union has been hard at work dealing with the issues of the impact of technology. Today we have several programs devoted to these issues. After giving you some background information on how this came about I will describe these programs to you in detail.

In the late sixties we began to realize that our members had some problems which were not being dealt with so successfully in collective bargaining. These were basically problems of job pressures, and by job pressures I simply mean the total disregard by management of legitimate complaints by workers.

We conducted two major job-pressure surveys in 1969 and in 1973 to determine the scope and the nature of the problem. We were, frankly, somewhat surprised by the strength of the results. Large proportions of our members agreed that management did not trust them to do a good job or to make sensible decisions where necessary, and that this lack of trust caused serious stress and discontent at work.

Then the question was: What could we do about it?

We took a number of steps through collective bargaining, but these steps, though important, did not solve the problems of the daily workplace. Collective bargaining was not able to change the basic relationship between management or workers or to increase our members' say in their jobs. We found that we needed a way to tackle issues which were not easily resolved in contract language.

During the 1970's the problem of job pressures was aggravated by a new factor—the wave of computer-based technological systems which began to pour out of the Bell Labs. These systems eliminated jobs, and they also changed the remaining jobs in ways that increased stress on workers.

They centralized work. New repair systems, for example, have brought workers under the control of computerized scheduling centers in far distant cities, robbing them of autonomy. The technology often reduced jobs to mechanical repetition. "I used to give services to customers," said one operator, "now I just feed a computer."

Most of all—most of all, computers have greatly increased management's ability to monitor and control every moment of a worker's day.

From our productivity study we found that technological change over the years has caused the composition of employment to shift in favor of management employees. Supervisory hours worked grew from 58.9 million hours per year in 1947 to 120.2 million hours in 1978.

Telephone operators worked 402 million hours per year in 1947, but this plummeted to 177 million hours in 1978 because of the elimination of the operators' jobs by technology.

Increased management control is exhibited by the fact in 1947 there were 12 operators for every supervisor, but by 1978 there were more supervisors than operators.

To understand these problems think of the old cordboard that operators used until about 15 years ago. That is the piece of equipment on which calls came into the central office, were received by the operator, and then plugged into a circuit that carried them to their destination.

Although that equipment is still used in some rural parts of our country it has been largely replaced by the TSPS. TSPS stands for Traffic Service Position System, and is the computerized successor to the old cordboard.

This system allows for the elimination of local phone offices, paces the flow of calls to the individual operators, catalogs the operator's average work time for each call, predicts the future flow of calls, schedules the operator's breaks, and in general welds the operator to the equipment.

Combined with the scripted responses that the operators are required to provide, the equipment removes all decisionmaking and human responses from the operator's job.

CWA has consistently made excellent gains for its members through collective bargaining. But we found that signing a national agreement every 3 years with the Bell System was not always the best way to address the issues of technology that occurred on the shop floor. As a result, in our 1980 negotiations CWA and A.T. & T. agreed to set up three joint programs to deal with day-to-day issues of the workplace.

The three joint projects were technology change committees, a national quality-of-work-life committee, and a national job evaluation committee.

We also negotiated several other benefits and ways for our members to deal with the human impact of technological change. They are:

Supplemental income protection benefits available to workers declared surplus by the company because of technology; a letter of agreement eliminating diagnostic remote monitoring; a technological displacement clause giving workers the alternative to accept a termination allowance instead of being transferred to a lower paid position because of technological change; a reassignment pay protection plan which insures that long-term employees who are downgraded because of technological change will suffer no reduction in pay; we upgraded the operator's job in 1980 and the service rep job in 1977; and additional holidays and vacation time.

We are also getting underway several studies on technology and stress in the public sector.

Now let me return to the three joint committees I mentioned. First I will describe to you our efforts to deal with technological change.

Our 1980 contract with the Bell System set up a technological change committee in each of the Bell System's operating companies, Western Electric and Long Lines. Each committee consists of not more than three union and three company representatives. The committees talk about employment and training for workers affected by technology and discuss possible applications to the existing programs such as SIPP and RPPP or transfers.

The technology change provision requires the company to provide the union with at least 6 months' notice of any "major technological changes, including changes in equipment, organization, or methods of operation which may affect employees represented by the union."

This provides our district officers with the same data used by officers of the operating company, and it provides the leadership with the leadtime necessary to analyze changes, assess the impact, and recommend alternative methods of implementation in this forum.

Right now the committees are learning to work together to solve problems and build up confidence. We are also trying to build up a network through our stores to channel information to the committee. We feel that this is the best way to harness the knowledge of the true experts on the effect of technological change, the workers.

This approach does not only increase participation by the workers but is also likely to create practical solutions to the problems new technology creates.

After the parties have learned to acknowledge and respect the concerns of others it may be time to introduce a vertical-slice approach to the introduction of new technology. This would mean that a group of employees from all levels—management and workers—of the company, down to the shop floor, would meet to decide how the technology should be introduced.

In the future CWA hopes to have complete and effective union involvement in all aspects of technological change, including veto power over the introduction of new equipment.

Through negotiations we hope the company will allocate part of its budget to CWA to conduct studies—either jointly or separately—on the human impact of technological change.

Now let me discuss briefly with you our second joint project—worker participation. The joint national CWA/A.T. & T. Working Conditions and Service Quality Improvement Committee set up by our 1980 contract is developing a process to help our members deal with the issues of job pressures and technological change at the workplace.

The first step of the national committee was to reach an agreement on a statement of principles which is to be the framework for all worker participation activities within the union at A.T. & T. It is the values of both groups—the union and the management.

In brief, these guidelines are:

First, that workers' rights are explicitly protected. This means no layoffs or speedups will occur as a result of QWL activities, and that participation in this program is voluntary.

Second, that the activities not intrude on collective bargaining. Workers always retain the right to pursue complaints through the grievance procedure.

Third, there should be an explicit commitment to human goals in addition to economic ones. We know that workers who are treated fairly are our highly productive workers.

Fourth, the union should be involved on an equal basis in all phases of the process—from planning to implementation.

Fifth, all decisions about work changes should come primarily from discussions by the workers themselves.

The next step must be to provide training and education about worker participation to the lower levels of the union, and of course, without question, the company. The national committee has agreed on a 2-day training program on QWL. We expect in the next year or so every CWA official, down to the steward level, will have participated in at least the first day of the training. We have already trained over 150 of our union staff and over 100 local officers.

Finally, I will explain to you our third way of dealing with the effects of technology—the joint CWA/A.T. & T. Occupational Job Evaluation Committee. This is a joint national committee of three union and three management representatives. I am the chairman of the union portion of this committee.

Despite initial skepticism about job evaluat~~ion~~ CWA entered into this project because of a need to make sure our members were being properly compensated for their work. A job evaluation plan jointly developed and implemented by CWA will help us identify and adjust compensation where technology has rendered traditional wage relationships meaningless.

Only with union involvement can we be sure that our members are being paid for the increased skills, responsibility, and adverse working conditions that result from technological change.

As you can see CWA is deeply involved in the human impact of technological change.

I have several recommendations to enable others to learn from our experience. These recommendations can be handled through collective bargaining and often supported and legitimized through national legislation.

One, labor must be fully and effectively involved in all aspects of the technological change process if the benefits of such changes are to outweigh the costs. Workers, not social scientists or engineers, are the true experts on the human effects of technological change.

Training is required to insure that labor's voice is effective and not merely cosmetic. Workers and managers should be trained together to be able to deal effectively with technological developments. To deal with technical issues, research projects conducted by nonprofit organizations and universities should be supported by Government funding.

Once new technology is implemented workers must receive adequate training to enable them to maintain and improve their skills to work with new technology. Such programs have existed for years in Europe, with great success.

Workers and their union representatives must be assured access to all necessary information on technology. How can you express your concerns on technology if you don't even understand it?

Companies should be required to give mandatory advance notice of shutdowns, layoffs, closing, or technological changes.

Businesses must assume their public responsibility and account for the human effects of technological change. At regular periods or when any significant change occurs businesses should supply affected parties with the following:

First, a rationale for the technological change, including how it fits in with organizational values and the economic impact on industrial organizations in the long run.

Second, a statement of the human effects of technological change, including the impact on total employment, skill requirements, the shift in the types of employment—technical versus clerical, for example—mental and physical stress, social isolation, working conditions, lack of decisionmaking, and health and safety issues.

Finally, the administration—the Government—should maintain an economic policy to promote full employment, an equitable income distribution, and strong economic growth. Needed social programs that improve our standard of living should not be sacrificed in order to produce more objects for consumption. Our best course of action—and this has always been our best course of action—is to make use of our greatest natural resource—labor.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Straw follows:]

STATEMENT ON THE HUMAN IMPACT OF TECHNOLOGICAL CHANGE

BY RONNIE J. STRAW, DIRECTOR
DEVELOPMENT AND RESEARCH DEPARTMENT
COMMUNICATIONS WORKERS OF AMERICA
SEPTEMBER 15, 1981

My name is Ronnie Straw and I am the Director of the Development and Research Department of the Communications Workers of America (CWA). We represent over 600,000 workers and administer in excess of 700 contracts in the telecommunications industry which, as you know, has been characterized by rapid technological change over the years. We also represent over 60,000 workers in the public sector and other industries. Today I would like to discuss with you our Union's experience and special knowledge of the impact of technological change on workers at the American Telephone and Telegraph Company (AT&T). I want to compliment this subcommittee for holding hearings on a subject that will grow in importance as we move in the microelectronic age, and I would also like to compliment Congressman Lundine for his pioneering legislative efforts in the area of labor-management cooperation.

In recent years, many American workers in a variety of jobs have observed first-hand the rapid introduction of new technology into the workplace. Today, technological developments reach far beyond the workplace and affect everyone, both at work and at home. Elaborate information systems allow banks and other institutions across the country to investigate personal credit records, and now AT&T wants to get into the news business.

New technology can provide a host of benefits to our nation. Decreased costs and improved productivity that result from technological change can supply a much needed boost to our lagging economy. New technology can lead to our improved standard of living, enabling us to enjoy a greater number of improved products and services. Technology can bring us everything from time-saving gadgets for the home to life-saving medical devices and can even prevent the world from running out of energy and natural resources. In the workplace, developments in technology can improve working conditions and open up new jobs.

But our eagerness to reap the benefits of technological change should not blind us from its possible costs. Businesses generally promote new technology in a short-sighted attempt to decrease costs, paying little or no attention to the human effects of innovation. Advancements in technology can have strongly adverse effects on workers by reducing skill requirements, eliminating jobs, fostering mental and physical stress, creating health and safety problems and fracturing jobs. Workers are heavily monitored and controlled by management - and by machines - causing a dehumanization of the workplace. Employees begin to feel like mere appendages to the machinery, and not like individuals.

These adverse effects of technology can be so overwhelming as to negate any of the desirable benefits. To illustrate this point, let me describe to you the study we conducted at CWA. Prior to negotiating a national agreement with the Bell System in 1980, CWA engaged a noted economist and productivity expert to study labor's contribution to productivity in the Bell System. Productivity has been growing at an accelerating rate for years in the Bell System, averaging a growth rate of over seven percent per year in the 1970's compared to barely over one percent for the total private United States economy. The Bell System has consistently contended that this rapid growth has been due to technology. Our study, however, showed that economies of scale, and not technology, have caused the high productivity growth, and labor has made a substantial contribution to this growth.

We found that as new technology has been introduced into the Bell System over the years, the effect has been sometimes to decrease costs and sometimes to increase costs. The net effect over the period we studied (1947-1978) has been just about zero. Thus, technological change in itself at the Bell System has had no substantive role in the industry's high productivity growth. Instead, it is the hard work of labor together with other inputs that have enabled the Bell System to take advantage of increasing returns to scale and achieve high productivity.

Apparently, this unfortunate outcome of technology arose because the Bell System introduced new technology into the workplace with no regard for human needs. Because labor and capital work together in fixed proportions in the Bell System, any rapid change in technology would upset this balance and have a negative effect on productivity. At times, the disruption actually caused costs to rise. In the long-run, these setbacks cancelled out any benefits that might have accrued from the new technology.

Does this mean that attempts to increase productivity through technological change are in vain? Absolutely not. We at CWA believe that society can achieve the benefits of innovation without sacrificing human needs. But the only way to ensure that this occurs is to provide for effective worker involvement in all aspects of technological process, from inception through implementation and, finally, replacement.

In the past decade, our Union has been hard at work dealing with issues on the impact of technology. Today we have several programs devoted to those issues. After giving you some background information on how this came about, I will describe those programs to you in detail.

In the late sixties we began to realize that our members had some problems which were not being dealt with so successfully in collective bargaining. These were, basically, problems of "job pressure."

We conducted two major job pressures surveys in 1969 and 1973 to determine the scope and nature of the problem. We were, frankly, somewhat surprised by the strength of the results. Large proportions of our members agreed that management did not trust them to do a good job or to make sensible decisions where necessary, and that this lack of trust caused serious stress and discontent at work.

Then the question was: what could we do about it? We took a number of steps through collective bargaining. But these steps, though important, did not solve the problems of the daily workplace. Collective bargaining was not able to change the basic relationship between management and workers, or to increase our members' say in their jobs. We found that we needed a way to tackle issues which were not easily resolved in contract language.

During the 1970's, the problem of job pressures was aggravated by a new factor: the wave of computer-based technological systems which began to pour out of the Bell Labs. These systems eliminated jobs, and they also changed the remaining jobs in ways that increased stress on workers. They centralized work: new repair systems, for example, have brought workers under the control of computerized scheduling centers in far-distant cities, robbing them of autonomy. The technology often reduces jobs to mechanical repetition. "I used to give service to customers," says one operator, "Now I just feed a computer."

Most of all, computers have greatly increased management's ability to monitor and control every moment of a worker's day. From our productivity study we found that technological change over the years has caused the composition of employment to shift in favor of management employees. Supervisory hours worked grew from 58.9 million hours per year in 1947 to 120.2 million hours in 1978. Telephone operators worked 402.1 million hours per year in 1947, but this plummeted to 177.1 million hours in 1978 because of the elimination of the operators' jobs by technology. Increased management control is exhibited by the fact in 1947, there were 12 operators for every supervisor, but by 1978 there were more supervisors than operators.

To understand these problems, think of the old cordboard that operators used until about 15 years ago. That is the piece of equipment on which calls came into the central office, were received by the operator, and then plugged into a circuit that carried them to their destination. Although that equipment is still used in some rural parts of our country, it has been largely replaced by the TSPS. TSPS stands for Traffic Service Position

System and is the computerized successor to the old cordboard. This system allows for the elimination of local phone offices, paces the flow of calls to the individual operator, catalogues the operator's average work time for each call, predicts the future flow of calls, schedules the operator's breaks and in general welds the operator to the equipment. Combined with scripted responses that the operators are required to provide, this equipment removes all decision-making and human responses from the operator's job.

CWA has consistently made excellent gains for its members through collective bargaining. But we found that signing a national agreement every three years with the Bell System was not always the best way to address issues of technology that occur on the shop floor. As a result, in our 1980 negotiations, CWA and AT&T agreed to set up three joint programs to deal with day to day issues of the workplace. The three joint projects were technology change committees, a national quality of work life committee and a national job evaluation committee. I will describe each of these shortly.

We also negotiated several other benefits and ways for our members to deal with the human impact of technological change. They are:

1. Supplemental Income Protection Plan (SIPP) - These benefits are made available to eligible workers declared surplus by the Company because of technology, to a maximum of $18,000 per year.

2. Monitoring - We negotiated a Letter of Agreement with the Company eliminating diagnostic remote monitoring.

3. Technological Displacement - This clause gave workers the alternative to accept a termination allowance instead of being transferred to a lower-rated position because of technological change.

4. Reassignment Pay Protection Plan (RPPP) - This ensures that long-term employees who are downgraded because of technological change will suffer no reduction in pay.

5. Upgrades - We upgraded the operator's job in 1980 and the service representative's job in 1977. Both jobs had become underrated as technology added to the pressures and demands of the jobs.

6. Contracting Out Work - In a Letter of Understanding with the Company we ensured that telephone work would not be contracted out.

7. Time Off - We secured additional holiday and vacation time for our members to help them deal with the pressures of their jobs.

We are also getting underway several studies on technology and stress in the public sector.

Now let me return to the three joint committees I mentioned. First, I will describe to you our efforts to deal with technological change.

Our 1980 contract with the Bell System set up a Technology Change Committee in each of the Bell System Operating Companies, Western Electric and Long Lines. Each committee consists of not more than three Union and three Company representatives. Usually an Assistant Vice President from the Company and the Bargaining Committee Chairman from the Union are on the committee. The committees talk about employment and training for workers affected by technology and discuss possible applications of existing programs such as SIPP, RPPP or transfers.

The technology change provision requires the company to provide the Union with at least 6 months notice of any "... major technological changes (including changes in equipment, organization, or methods of operation) which may affect employees represented by the Union." This may not sound like a major advance and in fact, some operating companies were providing such notice before 1981. But the reason that we are so pleased with this development is that it provides our district officers with the same data used by officers of the operating company, and it provides the leadership with the lead time necessary to analyze the changes, assess the impact, and recommend alternate methods of implementation in this forum, or others established under the contract.

Because the program is so new, it is too early to make any judgments of its effectiveness. But early reports are very encouraging. Right now, the committees are learning to work together to solve problems and build up confidence.

At present, we are also trying to build up a network through our stewards to channel information to the committee. We feel that this is the best way to harness the knowledge of the true experts on the effects of technological change: the workers. This approach does not only increase participation by the workers, but is likely to create practical solutions to the problems new technology creates.

It is our hope that the committees will mature and expand their scope of responsibility. After the parties have learned to acknowledge and respect the concerns of the other, it may be time to introduce a "vertical slice" approach to the introduction of new technology. This would mean that a group of employees from all levels of the Company, down to the shop floor, would meet to decide how the technology whould be introduced. A truly cooperative effort could be quite successful in reducing the hostility and apprehension that often arises from new equipment and in contributing to its most efficient use.

This strategy, however, places a heavy burden on both the Union and the Company. If we are to be involved in the decision-making process in the introduction of new systems, we will have to do more than just react to those parts that are onerous to our membership. In the future, CWA hopes to have complete and effective Union involvement in all aspects of technological change, including veto power over the introduction of new equipment. Through negotiations, we hope the Company will allocate part of its budget to CWA to conduct studies, either jointly or separately, on the human impact of technological change.

Now let me discuss briefly with you our second joint project, worker participation. The joint national CWA/AT&T Working Conditions and Service Quality Improvement Committee set up by our 1980 contract is developing a process to help our members deal with issues of job pressures and technological change at the workplace.

We negotiated the formation of this quality of work life committee after we completed a study in 1980 for which we interviewed over 100 Union officers and staff. The study concluded that job pressures caused by oversupervision and technological changes could be handled through increased participation. And even more important from our point of view, it concluded that union involvement would make a significant difference in the process.

There were three reasons for this. One was that workers were more willing to trust the process if they felt their rights were clearly protected. The second was that programs with unions stressed human values, broadening the narrow productivity focus of most management programs. And the third was that union involvement tended to stabilize the efforts: it meant that they were no longer dependent, as in many other cases, on the backing of a single manager who might soon move on to another job or change his mind. It gave participation a second leg to stand on. So on those bases we decided it was worthwhile for us to take up the issue actively.

The first step of the national committee was to reach agreement on a statement of principles which is to be the framework for all worker participation activities within the Union at AT&T. In brief, these guidelines are:

-- First, that workers' rights are explicitly protected. This means no layoffs or speedups will occur as a result of QWL activities; and that participation in them is voluntary.

-- Second, that the activities not intrude on collective bargaining. Workers always retain the right to pursue complaints through the grievance procedure. And any changes which affect contract provisions must pass through normal bargaining channels.

-- Third, there should be an explicit commitment to human goals in addition to economic ones. We have no objection to increasing productivity -- we want AT&T to be an efficient and profitable company. But the values of safety, dignity and human development at work should be equal in importance.

-- Fourth, the union should be involved on an equal basis in all phases of the process, from planning to implementation.

-- Fifth, all decisions about work changes should come primarily from discussions by the workers themselves.

The next step must be to provide training and education about worker participation to the lower levels of the union -- and, of course, the company. The National Committee has agreed on a two-day training program on QWL. We expect that in the next year or so every CWA official, down to the steward level, will have participated in at least the first day of this training. We have already trained over 150 of our Union staff and over 100 Local officers.

As for starting the process of actual participation on the shop floor, we plan to move carefully. Once the local programs begin, they will be quite independent and work out their own way of approaching QWL process. But they cannot succeed if a strong climate of support has not been created at the higher levels first.

But there are already a few exceptional cases of local projects, undertaken jointly by Union and Management, which have been going for a year or more. These programs in Illinois and Michigan have already taught us a great deal which will help in the further development of QWL efforts.

For management, worker participation requires a basic change of style. When I studied at a University Management School, and after spending a considerable amount of money, I asked what did they teach me. I concluded that they taught me to "control, control, control." No one ever said to me, be a leader - provide leadership, lead, lead.

We believe that the controlling approach to management is counter-productive. In the long run, human values support economic ones. All the evidence shows that workers that are treated fairly and given the chance to contribute fully to their work are highly productive. But managers don't always see it. The reason is that they tend to focus more on the short run, and you can always get more immediate production out of workers by pushing them and increasing control. The costs in terms of worker dissatisfaction often don't show up until the manager responsible has moved on to another position.

Given this, the Union's role in the QWL process is crucial: to stick consistently to the long-term goal, guided by the human values which we have always advocated. We see worker participation as a tremendous opportunity, as well as a challenge. The results will be a strengthened Union and hopefully all parties in the industry will benefit.

Finally, I will explain to you our third way of dealing with the effects of technology, the joint CWA/AT&T Occupational Job Evaluation Committee. This is a joint national committee of three Union and three management representatives. I am the Chairman of the Union portion of this committee.

We are charged with developing a job evaluation plan for the Bell System that produces a hierarchy of jobs acceptable to both parties. We have met monthly for the past year and are close to reaching agreement on a plan. We have decided on a methodology for documenting work and are close to agreement on a set of compensable factors and a system of scoring jobs. We plan to test out our job evaluation plan in one Company over the next year. When that is accomplished, we will be ready to recommend a plan to the CWA and AT&T national bargainers in time for 1983 negotiations.

Despite initial skepticism about job evaluation, CWA entered into this project because of a need to make sure our members were being properly compensated for their work. Technology has drastically changed jobs across the country. A job evaluation plan jointly developed and implemented by CWA will help us identify and adjust compensation where technology has rendered traditional wage relationships meaningless. Only with Union involvement can we be sure that our members are being paid for the increased skill, responsibility and adverse working conditions that result from technological change.

As you can see, CWA is deeply involved in the human impact of technological change. I have several recommendations to enable others to learn from our experiences: These recommendations can be handled through collective bargaining and often supported and legitimized through national legislation.

1. Labor must be fully and effectively involved in all aspects of the technological change process if the benefits of such change are to outweigh the costs. Workers, not social scientists or engineers, are the true experts on the human effects of technological change.

   I would like to point out here that in Norway and Sweden, the success of joint efforts at the firm level is due to support of such projects by national legislation. I would like to recommend the formation in this country of a tripartite committee of business, Labor and government to study and analyze joint approaches to workplace problems in the United States.

2. Training is required to ensure that Labor's voice is effective and not merely cosmetic. Workers and managers should be trained together to be able to deal effectively with technological developments. To deal with technical issues, research projects conducted by non-profit organizations and universities should be supported by government funding.

   Once new technology is implemented, workers must receive adequate training to enable them to maintain and improve their skills to work with new technology. Such programs have existed for years in Europe, with great success. Since 1964, West Germany has offered every adult the right to as much as two full years of training or retraining. Training costs, an income subsidy which is inversely related to the previous wage and sometimes even moving and rental costs are all covered. Once this program proved successful, both France and Britain passed similar legislation, and Denmark and Sweden have used this type of program for years.

   The government should also continue to support jobs training and bring programs such as CETA to previous funding levels.

3. Workers and their Union representatives must be assured access to all necessary information on technology.

4. Companies should be required to give mandatory advance notice of shutdowns, layoffs, closings or technological change.

5. Businesses must assume their public responsibility and account for the human effects of technological change. At regular periods or when any significant change occurs, businesses should supply affected parties with the following:

   a. A rationale for the technological change, including how it fits in with organizational values and the economic impact on industrial organization in the long run.

b. A statement of the human effects of technological change, including the impact on total employment, skill requirements, the shift in the types of employment (technical vs. clerical, for example), mental and physical stress, social isolation, working conditions, and health and safety.

6. Finally, the Administration should maintain an economic policy to promote full employment, an equitable income distribution and strong economic growth. Needed social programs that improve our standard of living should not be sacrificed in order to produce more objects for consumption. Our best course of action is to make use of our greatest natural resource - Labor.

Mr. LUNDINE. Thank you very much. I am going to—rather than beginning the questioning myself—I'm going to call on Mr. Dymally. Do you have a question?

Mr. DYMALLY. Mr. Chairman, thank you very much. I don't have a question as such although Mr. Straw may want to respond. What I have to say may not be relevant to his testimony and may not even be significant.

Most publications in America are controlled by management; therefore, one reads about labor being the cause of lack of productivity. On the other hand, Japanese productivity is deeply rooted in their culture. Retrospectively the closing of Japan by the Shogun dynasty might have been the best thing that could have happened, as the way was developed for a sense of extended family and national pride and these phenomena result in productivity. I am not going to suggest that we have company unions as they do there.

What we have in America on the other hand is an adversary system where labor does not speak to management and management looks askance at the university community.

In Japan they have a combination, as is the case with semiconductors. The Government has just advanced large sums of money to a combination of the university, the Government, the employer, and the worker to study the American semiconductor industry with the hope of taking us over in 10 years.

On the other hand we have a system where Congress passes legislation, then the Government issues regulations; employer has to execute that by passing the cost on to the consumer. Labor then protests; the politician goes into the district and hears the bodies protest; he comes back to Congress and demagogs the very legislation that he had passed.

And so we have all of these systems working against each other—with the exception that this is not found in agriculture.

Land-grant college has a close relation with the agricultural agent who then works with the farmer. If the farmer has a problem, he speaks to the agent, who then develops a program and relays it to the university. The result is that we are No. 1 in agriculture and will probably stay that way.

That is the only system in America that is not adversary. All the others are adversary systems. A good example is the automobile and the EPA standards we have issued from Congress. We have four manufacturers and have developed four different sets of emission controls. We have 50 States with 50 different sets of regulations, and 5,000 politicians who are all criticizing.

And so we have this constant turmoil in our system as opposed to the Japanese system which is nonadversary, characterized by all parties working together.

I said what I had to say. It might not be very significant, but that's been my observation.

Mr. **Straw**. You know, different cultures produce different results, but I recently heard a Japanese professor from the University of Tokyo speak in Chicago, and he said that the Japanese hoped that in the future they would be as productive as the American worker. That was one of his comments, which sort of surprised me.

Even though their rate of growth is much greater than ours—because their economy is in an earlier stage of development—the point about labor productivity and productivity in this country—you know the studies that were done were done by a number of noted economists on productivity for the years 1970 through 1980 show that the reason for the local productivity in this country is not labor, but three or four recessions that we've had to deal with. And we are continuing these policies in the Reagan administration.

As far as the adversarial relationship, we have no problem with the adversarial relationship. It has worked very well. It does very well. But we just can't seem to solve our problems, we can't seem to solve some of our daily work problems, and that is why we are shifting to the shop floor and shift to looking at technological change.

That's about all I have to say. We like the adversarial relationship. We think it's done very well for this country in the past.

Mr. **Lundine**. Mrs. Heckler.

Mrs. **Heckler**. Do other unions also feel the need of some kind of a shared mission in terms of dealing with the growth of an industry and the changes and dislocations due to new technology being introduced. In other words, how widespread in general is the attitude you express within the whole labor movement? How many unions are supportive of the new attitude?

Mr. **Straw**. Well, I think that there have been a number of unions very actively involved, especially the autoworkers, and the steelworkers have been involved, but I think the real test is with A.T. & T. and CWA. I think this is the first time that we've had a national agreement that really affects over 600,000 workers. And A.T. & T. and CWA have an effect on what other industries and what other unions do. They are looking at it very carefully.

We think it is going to work. We think that we're going to solve our problems. We think that we're going to make A.T. & T. more productive than they were in the past. But at this stage we don't know. All the signs are good.

Mrs. **Heckler**. Why do you feel that CWA and the Steelworkers have been the cutting edge of this new direction?

Mr. **Straw**. Well, I just think—for one thing it's the leadership. It's always the leadership.

Mrs. **Heckler**. Labor leadership?

Mr. **Straw**. Yes. Partly labor leadership. Prior to Glenn Watts who was very progressive and very liberal we had Joe Beirne who was about the same way. We are in a highly technical industry but we're also in a very, very high-growth industry.

I think that our attitudes about technology have changed. The traditional labor position in this country which was set by Samuel Gompers at the beginning of the century when he said that labor's role is in negotiating wage increases and improving working conditions, he also said we have no right to be involved in management of the company.

I think that that is changing. I think that workers do feel in this country that the experiences of Sweden and Germany and Denmark and Belgium are experiences that have application in this country as well.

Mr. **Lundine**. Mr. Brown.

Mr. **Brown**. Your presentation brings up a number of interesting aspects that have been some consideration in this committee before. For example, you're placing a major emphasis on the quality of working life. I'd like to ask you in what manner you've handled the problem, if you have, of seeking some acceptable definition of measure of the quality of working life. Has that been a subject of study?

Mr. **Straw**. We have no problem with that. It's really rather simple and that's getting the decisionmaking down to where the people who do the work. It's as simple as that.

You know, let me give you an example. And a very simple example—a family example. Suppose you have a driveway and you're the father of the family and you have seven children and you have to get the driveway swept off. And you can do it one of two ways. You can say, "Go out there and get that broom"—you have seven children, right? And No. 1 does this and No. 2 you do this, and No. 3, you do this. Well you can say to that group—you can say this to your children—"The driveway needs to be swept off. Now you do it, but I want that done,"—say within 3 days. And you decide how you're going to do it. They make the decisions; they decide how it's going to be done.

Mr. **Brown**. Well, that's a fairly fair and simple example. But what if the seven children got together and said, "We don't want to sweep the driveway."

Mr. **Straw**. Then you have a different problem. You've got a management problem.

Mr. **Brown**. You've got a very real question involved there. Who gets——

Mr. **Straw**. I think workers are responsible. Workers aren't going to say they aren't going to work. Workers in the United States have always been responsible.

Mr. **Brown**. They'd be more responsible if they were invited to participate in the decision as to whether to sweep the driveway, wouldn't they?

Mr. **Straw**. That's right.

Mr. **Brown**. Well, I was hoping that there might have been a detailed analysis of this problem because of its deep theoretical ramifications. Now, of course you have cut across these theoretical ramifications by making it clear that the simple element of worker involvement and worker justice is a factor, and I think you're right on that. But that still begs the question.

What is worker justice and what is worker participation? It begs the question in the same way that the driveway example does.

Does it involve merely meeting the management decision to sweep the driveway in some acceptable fashion? Or does it involve deciding whether or not you need to sweep the driveway? Can justice, which is rather an abstract concept, be defined in a more concrete way so that we can set up reasonable guidelines as to how to achieve it in different situations? For example, in the family workplace.

Mr. **Straw**. Well, every situation is going to be different. And we expect it to be different. But let me give an example of one of our most successful worker participation projects in Chicago, Ill., affecting about 7,000 operators.

The group set up a steering committee—three union and three management representatives—and they described the values of the group, and then they set up committees. And the first thing they dealt with was this measurement of average work time per call, which simply measures the output per the operator. And every day they used to post the average work time for each of the operators on the board.

And the operators said, we don't mind you having figures on the output in this office but we don't like them posted on the board. And if you didn't meet a certain average they'd come in and say you didn't meet this certain average.

Well, the group got together and they said they didn't want to post it any more, and if a person had a problem with their productivity they should call them aside and talk to them about it.

And do you know what happened in that office? The average work time per call went down. In other words productivity went up.

Mr. **Brown**. Well, the pragmatic measure of any of these abstract concepts is whether they, as goals, are achieved. If the goal is higher productivity and you can achieve it through one course of action but not through another, you'd be crazy not to take the former course. And if that involves increased worker participation, pragmatically that's the course to take.

But I suspect that management might think, for instance, "If we let the workers participate in this where do they stop?" Will they ask for an opportunity to determine product line or investment of surpluses or other important policies, which, historically, have been considered to be absolute management prerogatives?

Mr. **Straw**. First of all, I don't know what a management prerogative is, and that's a philosophical question and people have been fighting it for years and——

Mr. **Brown**. I'm asking you to give us the correct definition.

Mr. **Straw**. I am not sure what the correct definition is, and that is why we are proceeding slowly and carefully in these efforts. But the point is that workers do contribute to the productivity of the company, and what's wrong with asking workers about the product line—to use your example? What's the problem here? The problem is management. One of the problems is management.

Let me give you an example of that. When I took over the Development and Research Department at Communications Workers they had about 10 economists down there and I realized that I didn't know a damn thing about management. So I asked to take off some time, and I attended the University of Michigan Academy of Managers School and I graduated from that school and I have a certificate that says that I'm a manager. And some labor person told me that you also have the grievances to prove it.

At any rate after I spent a considerable amount of time and effort at this management school I asked myself, "You know, what did they teach me?" And I concluded that they taught me one thing, and that was to control, to control, and to control.

You know, no one—no one at that university taught me anything about leadership, about being experimental or expansive, about being a resource to workers, I mean to use their talents and their abilities on the job, but they did teach me how to control. That's one thing I did learn.

Mr. **Brown**. Well, as is the case with other major philosophies today, that of management is in a constant state of change. However, we do have to reach some generally understood basis on which we can do this sharing of responsibility and involving of the workers.

I personally have no difficulty in going along with a much larger role for worker participation, up to and including policy roles on the board. And I see nothing wrong with codetermination as it's attempted in Europe. Yet it's not been proven to be a panacea by any means. The reason for this is that neither management nor labor can be invariably right when measured against an even broader criteria, that is, what's good for the public.

That may cause you some problems. To be very specific there has been some comment amongst economists and others that the problems with the steel industry are due to all too much cooperation between labor and management and an artificially high level of wages, which makes them noncompetitive with external producers.

I don't agree with that, but nevertheless that criticism is made. If it is true, then the public has a certain responsibility to overcome this overly zealous cooperation between management and labor. That's why I raised the question of what abstract standards we can set up for this new era of trust between labor and management. And I think it is a very real problem. Right now I think it's not the most urgent problem, that being overcoming the adversary relationship I suspect. But every good thing inherently produces some adverse effects.

So that was the reason for exploring these more theoretical aspects.

Mr. **Straw**. On the adversarial relationship we don't consider that a problem during negotiations. We think we need the adversarial relationships in collective bargaining otherwise you do get these sort of sweetheart agreements that you were sort of referring to—which I don't necessarily agree with in the steel industry.

Let me give you an example. When I went out to talk to the steering committee in Chicago I mentioned this adversarial relationship. I said we have a 3-year contract and we want to be adversarial during the negotiations. However we want to, as the contract language said, that the union and management will cooperate in order to increase the quality of service and the working conditions of workers.

And you know what those managers said to me? "You know, Ronnie, you're absolutely right," they said, "but do you know what's the matter? We were taught the other way.

"Now we were taught not to give the union a damn thing; we were taught never to cooperate with the union; we were taught to avoid them as much as possible." And they said, "Now we've got to turn around and do it the other way. That's where the problem is, you see."

The adversarial relationship is fine; it's done a beautiful job in the grievance procedure and in the arbitration procedure, but it's that cooperation in between.

Mr. BROWN. What participation has your union had in this major technological change taking place in the industry where A.T. & T. is seeking to go into the nonregulated competitive computer business?

Mr. STRAW. I'm not involved in that at all so I cannot comment on that.

Mr. BROWN. In the event that A.T. & T. divests itself of a large amount of its holdings, would the union at any point feel that they ought to be involved at least from the standpoint of protecting the rights of their members?

Mr. STRAW. It's a rather complicated process, but we do have a successor agreement in our contracts and will continue to represent the workers regardless of how A.T. & T. is split.

Mr. BROWN. Thank you.

Mr. LUNDINE. Mr. Shamansky.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

Mr. Straw, I don't think it's realistic for me to think that we do a proper job of discussing all the questions your testimony brings to mind because of the time limitations, but let me—just mention a couple and then maybe we can have lunch sometime and discuss the rest.

Mr. STRAW. All right.

Mr. SHAMANSKY. On page 2 of your printed testimony you said that we found that as new technology has been introduced into the Bell system over the year, the effect has been sometimes to decrease costs and at other times to increase costs. The net effect over the period we studied has been just about zero.

The notes in my margin says, "Really?"

Mr. STRAW. Really.

Mr. SHAMANSKY. I am curious as to your statement that technological change in itself has had no substantive role at the Bell system. Instead, you attribute it all to something called increasing returns to scale.

That is a novel concept to me. I'm not sure exactly what you're defining. In other words, if you go from hand changing to electronic that's scale and not technology?

Mr. STRAW. Well, that's technology.

Would you like to——

Mr. LUNDINE. Would you please identify your colleague. We are glad to have you answer any of the questions, but——

Mr. STRAW. This is Lorel Foged, and she's a senior economist with CWA and was responsible for coordinating the study on productivity, and I'll have her answer that question.

Mr. SHAMANSKY. It seems to me you've wiped out the whole definition of technology. What do you mean?

Ms. FOGED. OK. What we did is we tried to measure labor's contribution to the high productivity that has occurred at A.T. & T. We wanted to see just what the labor input was. To do that we first had to measure productivity and break it down into different components. The way that was done was to look at costs, to see how costs changed, average costs over the years, which was from 1947 to 1978.

What we found was that as the Bell system has increased in size—OK—the costs have declined. That's what I mean by economies of scale or increasing returns. That means when you increase output your costs will go down.

Mr. SHAMANSKY. Per unit.

Ms. FOGED. Right.

Mr. SHAMANSKY. But they have gone down.

Ms. FOGED. And they have gone down at a particular rate.

Mr. SHAMANSKY. But you're saying that the technology has, in this case, nothing to do with that decrease in cost per unit, the cost per call handled?

Ms. FOGED. In some instances it did.

Mr. SHAMANSKY. But the statement here says it didn't.

Ms. FOGED. In some instances, about 50 percent.

Mr. SHAMANSKY. Excuse me. I'm just reacting to the fact that the statement in your written testimony is much broader than the one you have just made. I'm not here to be antagonistic. I'm just simply saying this statement is so broad it is unclear.

If we may go on—because I'm conscious of the clock, believe it or not.

Mr. LUNDINE. You're a good economist.

Mr. SHAMANSKY. OK. On page 3 you have, and I think it's related to the other——

Mr. LUNDINE. Before you move on—would it be possible to get a copy of that study and make it a part of this record?

Mr. STRAW. That copy is not ready for release yet, but as soon as it is I will make a copy available for the record.

Mr. LUNDINE. Fine. If there is no objection, should it be available by the time that these hearings, record is concluded, I would like to make it a part of the record. I would also ask the approval of the members that if there should be any comments upon the study management or other interested parties that that might also possibly be made a part of the record—if it's available by the time we assemble the record.

Without objection, so ordered.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

On page 3 there is the statement that increased management control is exhibited by the fact in 1947 there were 12 operators for every supervisor but by 1978 there were more supervisors than operators.

The question again becomes: How many calls per employee were handled? And I am assuming because I can't believe it could be otherwise; that there were more calls per operator handled.

Mr. STRAW. Absolutely.

Mr. SHAMANSKY. All right. So then, just the mere fact that there were more supervisors than operators is not necessarily the governing criteria.

Mr. STRAW. Well, it's just the fact—we're saying that there were more supervisors than operators.

Mr. SHAMANSKY. Yes. But the question is, What does that mean?

Mr. STRAW. We think what that means is that the increased supervisory ranks are more than perhaps were justified.

Mr. SHAMANSKY. Well, OK.

Mr. STRAW. Right now the Bell system is in the process of eliminating a fourth level of their management structure.

Mr. SHAMANSKY. In terms of unit cost per call handled that may be a perfectly reasonable decision, unless you're telling me that we must have more operators than supervisors forever, and you couldn't possibly say that as an economist. I just don't believe you'd say that.

Mr. STRAW. Well let me go on if I may.

The point is, the point of this all is that there have been technology introductions and what we're saying is that the net effect has been zero. Because there have been times when the technology has positive effects on productivity and times when there are negative effects. And what we're suggesting is that there are some reasons for this in our report.

We're suggesting one reason is that they haven't involved a worker in introducing the new technology, and this has resulted in——

Mr. SHAMANSKY. If I may respond to that, I can agree with the last sentence. But it seems to have nothing to do with the first part of your statement. I think there is a role for labor, but the idea that it's a net zero—I just cannot intellectually understand that. But let's go on.

Mr. STRAW. I will be glad to explain that to you at lunch one day.

Mr. SHAMANSKY. I would like to.

Mr. STRAW. We can do that.

Mr. SHAMANSKY. OK.

On page 5——

Mr. STRAW. The subject, I mean the study is very complicated and we would be glad to——

Mr. SHAMANSKY. OK.

On page 6—this is from my notes——

Mr. LUNDINE. I understand your problem because I am going to have the same one.

Just one question. In the event that this study is not available in time to make it a part of this record could you now tell me who conducted the study?

Mr. STRAW. Peter Chinloy, a professor of economics at the University of British Columbia—in Vancouver, Canada—conducted the study.

Mr. LUNDINE. Thank you.

Mr. STRAW. We spent about 1 year digging out the data in order to do the study.

Mr. LUNDINE. I have read something—at least in your publications—about the highlights of it, so it's not something that hasn't been released. At least some of the conclusions of it have been released.

Mr. **Straw**. We've talked about productivity increases. We have not released the study yet. It hasn't been reviewed very properly by our——

Mr. **Shamansky**. Thank you, Mr. Chairman.

On page 6 there is the phrase: "union involvement in all aspects of technological change, including veto power over the introduction of new equipment."

The question then becomes, what are the criteria for the exercise of the veto power?

Mr. **Straw**. Well, it could be health and safety matters. It could be just——

Mr. **Shamansky**. How about number of jobs?

Mr. **Straw**. Well, I was just—that was the second point I was going to make. It could be the level of employment or unemployment.

Mr. **Shamansky**. OK.

Could another be the economic cost per call handled.

Mr. **Straw**. If they decided, I mean if the group decided that introducing this technology and further reducing employment then maybe they ought not—maybe they ought to have veto power over not introducing the technology because of employment.

Mr. **Shamansky**. Well, one——

Mr. **Straw**. The same is true of health and safety.

Mr. **Shamansky**. But on health and safety I'm making an exception. I didn't mention health and safety, about which I happen to agree.

One reason I think you can do this successfully with A.T. & T. is that I think we can agree it is a high-growth industry as distinguished from the steel industry.

It's only about 25 percent of Japanese industry that actually have job security and that is only evident in those very high-growth industries. So, I worry about these analogies between industries. I'm not sure anything you could do would have an effect on the steel industry, because technology has reduced the labor required and they have not been able to absorb the personnel in other parts of their industry.

Mr. **Straw**. The problem in steel is a problem of the national economy. If we had full employment we wouldn't have a problem in the steel industry.

Mr. **Shamansky**. Not necessarily—excuse me, sir. You can compete with a steel bar made in Western Europe or Japan on the American market. You cannot compete with these networks.

So again I worry about that kind of analogy.

On page 9 you make the statement: "To deal with technical issues, research projects conducted by nonprofit organizations and universities should be supported by government funding."

My question is, why? Why not the company and the union, who directly benefit from this?

Mr. **Straw**. Well, I mean I can see them providing grants for the coming year to do some studies. Right now we are in the process of doing a joint study on the effect of video display terminals on workers—the physical aspects as well as——

Mr. SHAMANSKY. Do you have a direct economic stake in doing funding studies like that?

Mr. STRAW. Well, a direct stake in funding studies like that?

Mr. SHAMANSKY. Yes. Do you want to know the result of the study?

Mr. STRAW. Yes; we're concerned about our workers—if that's what you——

Mr. SHAMANSKY. Then the question is, Why should the Government fund the study when those people who have a direct stake in the outcome——

Mr. STRAW. Well, why should the Government fund business organizations—if that's the Government policy to——

Mr. SHAMANSKY. I am just pointing out to you that those who have a most direct stake in the outcome might see it to their own benefit to take the initiative and fund such a study rather than wait for the Government to do it.

Otherwise, you say, it's not going to get done?

Mr. LUNDINE. Will the gentleman yield on that point? I also intended to ask about it.

Are you not suggesting that it is the responsibility of the company—and to some extent the union through its negotiation with the company—to devote some resources to research and development in human factors, but that occasionally Government support is necessary, if for no other reason than to produce credible information that the public is going to accept?

Mr. STRAW. Yes.

Mr. LUNDINE. I didn't mean to ask you a leading question, and I didn't mean to turn out to be the witness, but the gentleman from Ohio——

Mr. SHAMANSKY. I welcomed the chairman's question.

Mr. LUNDINE. For example, the gentleman from Ohio is troubled by the results of your study, as is this gentleman troubled by the results of your study. I can't wait to read it. But it is hard for me to understand how the world would be better off if we went back to early 20th century communications equipment. So here may be an area—I'd suggest to my colleague—where credible information which might be provided by the National Science Foundation funding research, because sometimes I suspect that he who funds research gets the answer that he wants.

Mr. SHAMANSKY. Mr. Chairman, I think that leads logically to the point that Congressman Brown was making. Of course, if you put the public interest in there and the public, I think, does have a role, especially where we are funding studies. The point is, especially in communications—telephone, let's say, where you have a monoploy by law—it is the public which ultimately pays the tab. It's foolish to suggest that the public has no role in this adversarial thing simply because management and labor will get together and wrap it all up. Who's going to pay the tab? Clearly the public is going to pay the tab in the rates.

You may feel very comfortable about the adversarial relationship during the negotiation; but I think its incumbent upon labor and management, especially in this field to understand that the public does have a role, because the public must of necessity pay for their agreements.

I don't think you can ask the public to pay for an agreement in which it did not have any say. And yet I think one can infer that message from your statement. I can't believe that's really your message.

I think that's enough damage for the time allotted.

Mr. LUNDINE. All right, I'll try to be as restrained as you were in asking questions.

I want to follow up on this idea of the degree of participation that—in technology change. The word "veto" frankly troubles me, too.

To be specific, could you first of all give me an example of a situation where human factors could have contributed to performance with the introduction of a new technology where maybe that didn't achieve all of its results without consulting the workers ahead of time? Is there a good example of that?

Mr. STRAW. Well, I think we've had a number of discussions over the visual display terminal, and they are having problems all over the country with our clerical workers, our workers who look at those day in and day out, flashing green lights, the background of the walls, eye strain, nausea, headaches, which were never considered prior to the implementation of that technology.

Mr. LUNDINE. Do you represent some of the clerical workers?

Mr. STRAW. Yes. Oh, yes, excuse me—about two-thirds of our members. Two-thirds of our 600,000 members are clerical and operators; one-third are craftsmen; 50 percent of our membership are women.

Mr. LUNDINE. Yes. This is a fascinating union, because you do have sort of different constituencies it would seem to me in your union.

On the point of stress, where is it the greatest? Can you make a generalization between operators and say linemen? Or craftsmen?

Mr. STRAW. We get most of the complaints from the clerical and operator groups, but we still have a high level of complaints from the craftsmen as well.

Mr. LUNDINE. All right. Now, I——

Mr. STRAW. You know, most of that stress is not being able to do a good job, to some extent.

Mr. LUNDINE. Right. I understood that point, and I do understand it's one of the most autocratic workplaces that I am aware of; that is, being a telephone operator. I understand that.

Mr. SHAMANSKY. On page 7 you say: "Fifth, all decisions about work changes should come primarily from discussions by the workers themselves."

Don't you think management ought to have a role in those decisions?

Mr. STRAW. Sure.

Mr. SHAMANSKY. Your statements sort of indicate that you want a veto power for the workers; that you want the workers to decide. Don't you have any feeling for the task of foreman or of the supervisor? They've got a job, too.

Mr. STRAW. I haven't criticized the foreman or supervisor. I think he does have a job for managing the resources of the company. All I am suggesting is that decisions at the workplace should be decided by the workers, the people who are actually doing the work, or how that work ought to be organized.

Mr. **Shamansky**. Shouldn't that be a joint discussion between first-line supervision and other levels of both management and worker?

Mr. **Straw**. Of course. Of course.

Mr. **Shamansky**. Yes.

Mr. **Straw**. I'm not suggesting——

Mr. **Shamansky**. I didn't think you were, but I wanted to clarify it, and it certainly sounds——

Mr. **Straw**. On second—I can see how you could draw that conclusion from that simple statement in there.

Mr. **Shamansky**. I assume that at this point in your quality of work life program it's really too early to give any evaluation or any results that have come from the application of this program.

Mr. **Straw**. I cannot give you any results, but I think that I can say that we've made—we have moved much faster than we ever anticipated, and we have educated from top down.

Mr. **Shamansky**. I was likewise fascinated with your testimony regarding effective training programs for workers in a changing technological environment in the workplace. You touch upon the central role which industry should play in training workers and assuring manpower needs are met. How can you assess the relative responsibility or role between the private sector and Government in meeting changing manpower needs as a result of—I hate the word manpower and I hate the word training. First of all it seems to me you train dogs, not people. However, I've never been able to come up with a better one, and I think you understand what I mean.

In this changing technological situation what do you believe are the respective roles of, in your case, A T. & T. and the Government in terms of meeting training needs for new technology?

Mr. **Straw**. Well, I think the main role of Government is to provide full employment period. I think, not period, but I think that the main role of the Federal Government is to provide full employment.

I think they also ought to provide manpower training programs for people who are displaced by technology and that would be very helpful.

Mr. **Shamansky**. I assume from several parts of your testimony that what you're essentially saying is that the adversarial system; that is, collective bargaining, has proved to be a very valuable instrument in dividing up the gains that have been achieved; but that collaboration or cooperation might be needed to assure that we continue to have gains. Is that a fair statement?

Mr. **Straw**. Absolutely.

Mr. **Shamansky**. Mr. Straw, I thank you very much. If the value of testimony is to be——

Mr. **Straw**. Oh, excuse me.

Mr. **Dymally**. Let me, just one——

Mr. **Straw**. Yes

Mr. **Dymally**. Mr. Straw, you were saying on the one hand that the adversary system was good and on the other hand you were saying we need cooperation between management and labor. Are you not wanting to have it both ways?

Mr. STRAW. Yes. During—when we are negotiating a contract, we believe that the relationship should be adversarial; we should not be friends; we should represent our members the same as the company should represent their stockholders. And we don't want it any other way. That's the way we want it.

But during the period when we sign that contract and the next contracts come due we want to work cooperatively to improve the working conditions of workers and the quality of service to customers, to the public.

Mr. DYMALLY. Semantics is such an important word in communications. You do not find a better word than adversary? Think about it, and include it in your report.

Mr. STRAW. OK.

Mr. DYMALLY. It seems to me that adversary has such a negative connotation. On the one hand you say we want to fight with you in the fall for a contract while at Christmas we want a share in the Christmas tree gifts. I would have some problems with that if I were an employer. Can we not find a middle ground?

Mr. STRAW. There's going to be a fight tomorrow night, and they are very adversarial in those rings for 15 rounds. I can assure you after that fight they are going to be friends.

Mr. DYMALLY. We see that as a one-time shot, though. One person is no longer the champ, whereas you want your workers to be champs for the full 3 year duration of the contract.

Mr. STRAW. I mean what you're driving at is a whole change in management technique, and even union technique, and that's what we're driving at. We want management to be—we want managers to be leaders. I was alluding to that. We want them to be resources to workers. We don't want union people to be adversarial all the time—you know, just taking a shot at management people. We want them to cooperate with them and try to improve productivity, try to improve the conditions of the worker, try to improve the service to the public—that's what we're trying to achieve here.

And I really don't see any contradiction. I am surprised that you do, although I don't see a contradiction.

Mr. DYMALLY. Just playing devil's advocate.

Thank you, Mr. Chairman.

Mr. LUNDINE. If the value of testimony is to provoke interest you've been very successful.

I thank you very much for your testimony. We really appreciate your sharing the experience in this important industry. I think it's worth noting that whereas it's very easy to understand labor-management cooperation in steel and autos, which you've identified as the other two primary sectors or leading unions at the cutting edge of this movement, because they are very threatened today, you're to be commended for your pioneering venture in an industry whereas it's been pointed out you're not particularly threatened.

Thank you very much.

Mr. STRAW. You're welcome.

Mr. LUNDINE. Now the next witness will be Bert L. Metzger, president of the Profit Sharing Research Foundation.

May I comment as Mr. Metzger's coming up we also will hear from William Koch of the Federal Aviation Administration and will try to get to Mr. Koch as soon as possible for those people who are interested in his testimony.

Mr. Metzger, we have your entire written testimony, together with the exhibits and we appreciate them. They will be made, without objection, in their entirety a part of the record, and you may proceed in any way you see fit. If you can summarize it we'd appreciate it.

[The biographical sketch of Mr. Metzger follows:]

BERT L. METZGER

BERT L. METZGER is president of the Profit Sharing Research Foundation, Evanston, Illinois. Before joining the Foundation in 1958, Mr. Metzger earned his M.A. degree in industrial psychology at Loyola University, Chicago, and gained first-hand experience in plant supervision, personnel administration, and production control at two Chicago-based companies -- Hamilton Industries and Ekco Products Co.

He has written many articles and books on profit sharing and employee stock ownership, including PROFIT SHARING IN PERSPECTIVE (a comprehensive guide to plan implementation), a major study on the INVESTMENT PRACTICES, PERFORMANCE, AND MANAGEMENT OF PROFIT SHARING TRUST FUNDS, and an intensive investigation into the intriguing question, DOES PROFIT SHARING (and Employee Stock Ownership) PAY?

Mr. Metzger is a frequent speaker on employee productivity motivation, and sharing/participative practices before business groups throughout the United States and Canada, including conferences sponsored by The Supermarket Institute, The Conference Board, American Management Association, Industrial Management Society, and Advanced Management Research, Inc.

He presented papers at the U. S. Department of Labor's first conference on "Humanization of Work" in Warrenton, Virginia, and at the first conference on "Productivity" sponsored by the National Commission on Productivity in Chicago.

In 1975, Mr. Metzger was part of a four-man U. S. contingent at the International OECD conference on "Workers' Participation" in Versailles, France.

In the 1975-1980 period, Bert Metzger wrote or edited the following seven booklets:

- INCREASING PRODUCTIVITY THROUGH PROFIT SHARING
- NEW HORIZONS FOR CAPITALISM
- THE FUTURE OF PROFIT SHARING
- SHARING A BUSINESS: PRESCRIPTION FOR GROWTH
- EMPLOYEE INVESTMENT CHOICE IN DEFERRED PROFIT SHARING
- PROFIT SHARING: THE INDUSTRIAL ADRENALIN
- PENSION, PROFIT SHARING, OR BOTH?

In addition, Mr. Metzger completed Volumes I and II of a major PSRF study of PROFIT SHARING IN 38 LARGE COMPANIES--Piece of the Action for 1,000,000 Participants.

Mr. Metzger cooperated with The Johnson Foundation in sponsoring an international conference in Racine, Wisconsin on "The Importance of Participation, Profit Sharing, and Employee Stock Ownership to the Future of Western Democracies." Top businessmen, professors, and government people from seven nations took part.

For a Les Echos conference in Paris in 1978, Bert Metzger produced a videotaped discussion of "Profit Sharing Experiences in the United States."

Mr. Metzger also participated in the ESOP Council of America's first and second annual conferences and spoke on the themes, "Achieving Motivation through Employee Stock Ownership" and on "Communications as the Life Blood of ESOP Motivation."

Mr. Metzger worked closely with the Profit Sharing Council of America in preparing research reports and statements for the President's Commission on Pension Policy.

Most recently, Mr. Metzger played an active role in the Toronto, Canada International Conference on "QWL and the 80's."

STATEMENT OF BERT L. METZGER, PRESIDENT, PROFIT SHARING RESEARCH FOUNDATION

Mr. METZGER. Thank you very much, Mr. Lundine.

I commend you and the committee for your investigation of the value of human resources in innovation and productivity.

I know that time is somewhat short. I will try to summarize my paper to bring out some of its highlights.

I am Bert Metzger, president of the Profit Sharing Research Foundation in Evanston, Ill. For a moment I will describe the foundation and its activities, because we are not as well known as the Communications Workers of America or the Steelworkers of America.

The Profit Sharing Research Foundation is a nonprofit publicly supported educational foundation.

Our primary job is to do the research and the analytical work which labor, business, government, and academia need on sharing/participative systems as they bear upon the subjects of motivation, productivity, inflation, labor relations, employment security, retirement income, and quality of work life.

Mr. Greenewalt, former chairman of the Board of E. I. duPont, once made the statement that if you give men the maximum of freedom and the maximum of incentive the achievements of the individual will be fused into the accomplishments of the institution.

The greatest challenge I think managers face today is to bring about that kind of fusion, that kind of unity of purpose between stockholders, management, and employees.

We must learn how to design our organizations so that technology is advanced and human requirements are satisfied simultaneously.

We must strive to create humane organizations with people as their most important resource, and at the same time recognize the vital role of technology, plant and equipment, and capital investment.

I think one of the reasons we have difficulty achieving this fusion between labor and management is because we have a fragmented approach to motivation in industry.

For example, we have over the years developed corporate pyramids to assure efficiency of production and have in many ways thwarted this efficiency.

We have not learned how to communicate very well up and down within this corporate pyramid and we are a long way from developing a common language.

But one of our most grievous faults is that we have a fragmented or splintered approach to motivation.

Every group within the company that makes a contribution to corporate success is rewarded in a different way. Executives are rewarded through salary, plus profit-sensitive bonuses and stock options.

Salaried employees receive salary plus status plus fringe benefits—usually unrelated to performance.

Hourly employees are compensated by pay, fringe benefits, and possibly by individual or small group production incentives.

Finally stockholders are rewarded through profit increases, increased dividends, and stock appreciation.

We have at least four major groups in our corporate structures—each one with a self-interest—each one with a separate target—no mutual targets, no common language.

It seems to me that we have, either by design or default, stratified our corporate pyramids and have developed horizontal modes of motivating each stratum. We have driven artificial wedges between this group and that, and then we wonder why alienation, lack of cohesion, and loss of employee identification with the firm plague our corporations.

We designed it that way; we have not changed our methods of compensation to unify all the factors going into the successful operation of a business.

I think this is a mistake. I think what we need today are cohesive incentives that cut vertically through the organization and pull the company together.

The declining productivity rate that we have experienced over recent years in the United States is largely due to the underutilization of the productive talents of our people.

Technology is very important, but there are many American plant managers who really feel in their gut that capital investment, plant and equipment, are the only factors that increase productivity. They do not believe that people count.

This attitude is counterproductive because it is almost self-fulfilling. If you really believe people are valuable, people count and can make a positive contribution, by golly they will.

If you really believe in your heart that people do not count, that only modern plant and equipment is important in increasing productivity, then people will perform only at the minimal level. They may not even utilize the equipment well. Your worst expectations will be fulfilled.

In effect, I am saying there are two sources that really create wealth—that is, man and machine. Both are crucial. Both count in the productivity equation.

Man makes a contribution, capital makes a contribution—there are two sources for gain, and they complement each other. The only way to get high productivity and lower costs is to achieve a successful marriage between plant and people.

No one can motivate any other person. Motivation is a machine, an engine that an individual turns on within himself. He turns on and maintains his own motivational engine.

All management can do is create a climate in which this kind of turn-on will most likely occur. For superior performance individuals want recognition and rewards.

This is where QWL, financial participation, and shareownership fit in—as a way to create a sharing climate in which excellence is recognized and rewarded financially and psychologically.

Each type of incentive plays its role—that is, financial satisfaction as well as psychological reward.

There are a number of ways to achieve financial participation in industry, and this is very compatible with activities for increasing the involvement of employees in the decisionmaking process.

There are a range of programs which we might describe as productivity-sharing or as gain-sharing plans—that is, Improshare, Scanlon, Rucker—profit sharing of either the cash, deferred, or combination variety, and also employee stockownership programs.

None of these programs is perfect. Each one has its own limitations and its own advantages. There is no one best way to share. You have to look at the particular environment in which the share program is going to be set up and decide what might be best for your people at that particular stage in your corporate development.

Eventually as the work force matures, develops better economic understanding, realizes what it takes to increase productivity and make a profit, and as the corporation itself expands, one type of plan may give way to another type.

Also, plans frequently work well together "in tandem."

May I now discuss with you bonus calculations under various productivity-sharing programs.

The Improshare plan—meaning improved productivity through sharing—was developed by an industrial engineer by the name of Mitchell Fein.

The plan deals with unit output related to man-hours of input. The following is a simplified example.

A single product plant of 100 employees produced 26,000 units over a 26-week base period in which employees worked a total of 104,000 hours. The average time to produce a unit was 4 hours—104,000 hours divided by 26,000 units equals 4 hours per unit.

Suppose an Improshare plan is introduced under which the 4 hours per unit is accepted as standard, and productivity gains (saved hours) are shared 50 percent—50 percent between employees and management.

In a given week under the plan, 102 employees worked a total of 4,080 hours (102 times 40 hours) and produced 1,300 units.

The value of the output (standard hours earned) would be 1,300 units times 4 hours per unit=5,200 hours—1,300 units multiplied by 4 standard hours per unit equals 5,200 standard hours earned.

Then 5,200 standards hours earned divided by 4,080 actual hours worked equals 1,120 gained hours.

The gain would be 5,200 standard hours earned minus 4,080 actual hours worked equaling 1,120 gained hours, with half or 560 hours going to the employees.

Translated into incentive pay, this gain would amount to 560 hours divided by 4,080 actual hours worked equaling 13.7 percent productivity bonus per employee.

Thus, 560 gained hours divided by 4,080 actual hours worked equals 13.7 percent of pay.

The company would also gain 560 hours. Employees and management would have a mutual interest in productivity gains in which they both share.

If plants have multiple product lines, standard hours per unit would have to be calculated for each product. In determining standard hours earned during a specific period, each product would be weighted by its volume.

Improshare has advantages and limitations as do all the other plans, but it provides a very close proximity between effort expended and reward enjoyed. It usually pays off on a weekly basis (sometimes monthly) and it normally pays off in cash. Improshare provides a frequent and tangible reward.

The second plan worthy of note is the Scanlon plan which shares the sales value of production between employees and the company.

You may have noticed that Improshare deals only with hours and units; that is, quantitative productivity. The Scanlon plan deals with the sales value of production—with economic productivity, if you will. Sales value of production for a given period is determined by taking gross sales, less returns and allowances, plus or minus an inventory adjustment to arrive at sales value of production.

Gross sales	$1,100,000
Less sales returns, allowances, discounts	25,000
Net sales	1,075,000
Add increase in inventory (at cost or selling price)	125,000
Sales value of production	1,200,000

A feasibility study over the historical past of 3 to 5 (or possibly 10) years would have revealed that total payroll costs (pay plus benefits) divided by sales value of production yielded an average ratio—representing a fair share that should go to labor. In our example of the Scanlon plan, 20 percent of the sales value of production equals allowed payroll costs.

In this case, 20 percent of the $1,200,000 equals allowed payroll costs of $240,000. Actual payroll costs during that period (including fringes, time paid-for-not-worked, pay of short-service employees, and the like) were only $210,000. This generates a $30,000 bonus pool which will be split between the company and the employees. In this example, 75 percent of the bonus pool goes to employees and 25 percent to the company. Out of the employees share, a reserve for bad months is established (25 percent) and the remaining 75 percent is distributed immediately in cash.

Allowed payroll costs, (20 percent of sales value of production)	$240,000
Actual payroll costs, including all costs of fringes, time paid-for-not-worked, short-term employees	210,000
Bonus pool	30,000
Company share (25 percent)	7,500
Employees share (75 percent)	22,500
Reserve for deficit months (25 percent)	5,625
Immediate distribution in cash (75 percent)	16,875

The Scanlon bonus for distribution of $16,875 amounts to 10 percent of participating payroll (excluding time paid-for-not-worked—for example, vacation, holidays—and pay of short-service employees).

The Scanlon process is more than determining a formula for sharing. Employee involvement techniques are part and parcel of the process. Usually production committees at the departmental level and a screening committee at the upper level are created to encourage employee motivation and involvement. Each department may have its own production committee to evaluate employee ideas and suggestions for improving the operation. Many ideas will be implemented at the departmental level. Other suggestions involving other departments, significant capital investments, and/or other corporate resource people will be reviewed and acted on by the screening committee.

The Scanlon plan is a process which strives to build employee identity with the firm, encourage employee participation, and achieve equity through the bonus.

The Rucker plan is quite similar to the Scanlon plan but involves a more refined formula for sharing. Instead of working with the sales value of production, the Rucker plan relates payroll costs to value added by manufacture (sales minus raw materials and services procured outside the company).

In the example of the Rucker plan which I would like to present, the ratio has been turned upside down to give you insight into another way of looking at the concept. Instead of payroll costs divided by value added by manufacture (which would closely resemble the Scanlon calculations), value added by manufacture is given per dollar of employee compensation.

Before a program is begun, a "standard ratio" is developed from an analysis of prior history which establishes the break-even performance for incentive pay. For example, this might be the historic profile for a given plant:

Value added per dollar of employee compensation:

1975	$2.67
1976	2.73
1977	2.61
1978	2.79
1979	2.59
1980	2.65

"Par" is the average—$2.673.

Incentive rewards are paid to all participants as a share of the improvement when actual results exceed this "standard."

Results for a future period might look as follows:

Wages paid	$80,000
Benefit costs	20,000
Total compensation	100,000
Times productivity standard of	$2.673
"Standard" production value	$267,300
Sales value actually produced	543,000
Less purchases	−249,000
Value added by manufacture	$294,000
Gain over standard	$26,700
Company share ($1.673 ÷ $2.673) or 62.59 percent	16,712
Employees share ($1.000 ÷ $2.673) or 37.41 percent	9,988

One-fourth or one-third of the employees share would normally go into a "balancing account" to offset potential deficit periods.

Three-fourths immediate cash bonus	$7,491
Participating wages of eligible employees	$76,482
Bonus rate percent	9.8

I would like to give you a few sample profit-sharing formulas which go one step further than the Scanlon and Rucker plans and emphasize not only economic productivity but final "bottom line" performance of the business. There are different ways of expressing profit-sharing formulas—some of them are specified percentages of profit that will be shared with workers over a period of time (with or without a prior reservation for capital).

30 percent of after-tax profits—with no prior reservation.

22 percent of pre-tax profits—with no prior reservation.

44 percent of after-tax profits—with a prior reservtion of 5¼ percent return on net worth.

There are sliding-scale formulas. The more profitable a corporation becomes, the higher percentage it shares with labor.

SLIDING SCALE FORMULAS

8 percent of first $100,000,000 of pre-tax profits, plus;

10 percent of the next 50,000,000, plus;

15 percent of any profits over $150,000,000.

As ROA (return on assets figure—i.e., consolidated income before taxes divided by average total assets) rises, the company contribution as a percentage of participating compensation increases:

ROA percent	Contribution percent to retirement account	Contribution percent on optional account	Total contribution percentage
11.5 or less	5	0	5
12	5	0.4	5.4
13	5	1.3	6.3
14	5	2.2	7.2
15	5.3	2.8	8.10
16	5.75	3.25	9.00
17	6.15	3.65	9.80
18	6.55	4.05	10.60
19	6.95	4.45	11.40
20	7.35	4.85	12.20
21	7.75	5.25	13.00
22	8.15	5.65	13.80
23	8.55	6.05	14.60
23.5 or more	8.75	6.25	15.00

Texas Instruments' formula for its universal profit sharing plan calls for company contribution to rise as a percentage of pay as return on assets (ROA) and the people effectiveness index (PEI) go up:

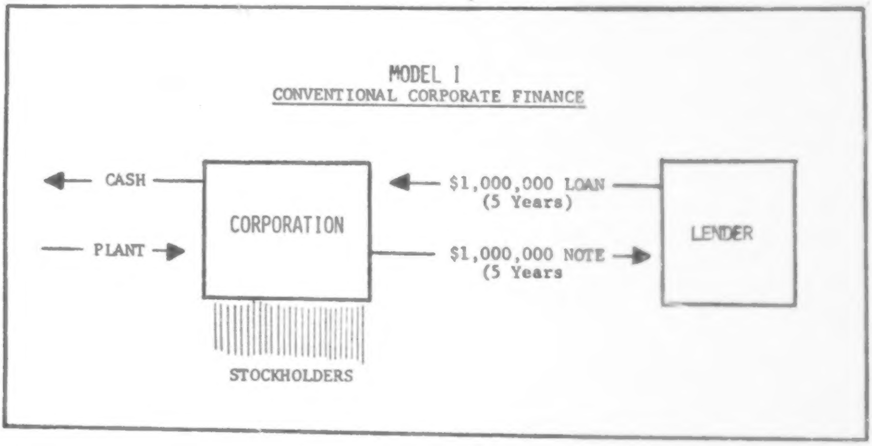
	ROA profit after taxes, average assets				PEI net sales billed, payroll
	2.0	2.5	3.0	4.0	5.0+
Percent:					
3.5	0	0	0	0	0
4.0	0	0	0	0	1.0
4.5	0	0	0	0	2.0
5.0	0	0	0	1.0	3.0
5.5	0	0	0	2.0	4.0
6.0	0	0	1.0	3.0	5.0
6.5	0	1.0	2.0	4.0	6.0
7.0	1.0	2.0	3.0	5.0	7.0
8.0	3.0	4.0	5.0	7.0	9.0

ROA profit after taxes, average assets					PEI net sales billed, payroll
	2.0	2.5	3.0	4.0	5.0 +
9.0	4.0	5.0	6.0	8.0	10.0
10.0	5.0	6.0	7.0	9.0	11.0
11.0	5.5	6.5	7.5	9.5	11.5
12.0	6.0	7.0	8.0	10.0	12.0
13.0	7.0	8.0	9.0	11.0	13.0
14.0	8.0	9.0	10.0	12.0	14.0
15.0	10.0	11.0	12.0	14.0	16.0
16.0	12.0	13.0	14.0	16.0	18.0
17.0 and above	14.0	15.0	16.0	18.0	20.0

Profit sharing focuses on all costs, encourages the acceptance of change and new technology, and any action that might increase bottom-line performance. Profit sharing also promotes teamwork between employees, management, and stockholders by providing a single target for their unified attention (i.e., the same operating results bring good and bad news to all alike).

Employees can also turn themselves on motivationally by having an ownership stake in the business. Employee stock ownership plans (ESOPs) warrant our attention.

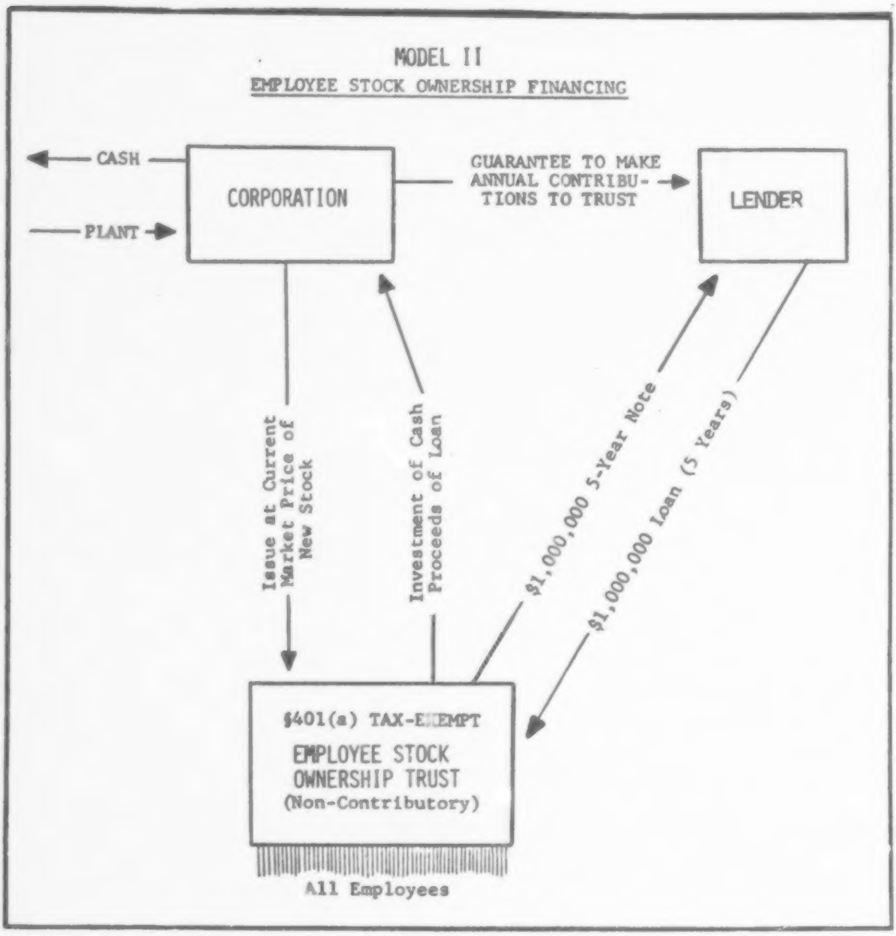
Model I depicts conventional corporate financing. The corporation negotiates a loan with the local lenders at a particular interest rate and term. The lender grants the loan. The money is invested in new plant and/or equipment and, hopefully, earns a profit on the capital investment. Earnings from the new plant/equipment flow to the existing stockholders. Interest on the loan is deductible as a business expense but the principal of the loan must be paid back with after-tax dollars. The same stockholders end up owning more. In the process, no new stockholders are created.



Model II provides insight into financing through a leveraged ESOP.

The corporation creates a 401(a) tax-exempt ESOP trust. The trust goes to the lender and gets the loan (usually with the company guarantee that it will make annual contributions to the trust to pay off the lender). The trust gives the money to the company in exchange for company shares. Debt is used to accelerate employee equity ownership. The money is invested in new plant and/or equipment and, hopefully, earns a profit on the capital investment. The company makes annual contributions to the ESOP trust and the trust pays the lender (principal and interest) with pre-tax dollars. In the process of payoff and allocation to individual accounts, new employee stockholders are created—a group of important people who may never have had an ownership stake in the corporation before (or in any corporation for that matter).

Leveraging through ESOP is a technique of using debt and equity to accomplish a goal of broadening employee stock ownership.


MODEL II
EMPLOYEE STOCK OWNERSHIP FINANCING
CASH
PLANT
CORPORATION
GUARANTEE TO MAKE ANNUAL CONTRIBUTIONS TO TRUST
LENDER
Issue at Current Market Price of New Stock
Investment of Cash Proceeds of Loan
$1,000,000 5-Year Note
$1,000,000 Loan (5 Years)
§401(a) TAX-EXEMPT
EMPLOYEE STOCK OWNERSHIP TRUST
(Non-Contributory)
All Employees

Based on PSRF experience, not all financial participation progams succeed. They work remarkably well in many firms, fairly well in others, and not at all in some.

Programs fail because:

Coverage can be too limited to promote teamwork. The plan can be divisive;

Company contributions sometimes are arbitrary and discretionary. Employees should have some assurance that they will get their fair share if the business actually prospers;

Sometimes companies share too little to be significant, under the threshold for effective employee motivation;

Sometimes they share too much and they do not have enough to reinvest in plant and equipment;

Plan features have to be kept in tune with the times and both company and employee needs must be considered;

The plan should not be taken for granted; it must be communicated regularly and enthusiastically;

Employees can not be kept in the dark on the program; they have to "know the score" because they are partners in the operation.

I would like to mention a number of conditions for successful motivation.

Commitment—commitment both from management all the way down from the top, commitment from union leaders if they are involved.

The plan must be designed to motivate people and flexible enough to meet their needs.

Hourly employees look at productivity through their special eyes. They really feel that increased productivity is a threat—at least a large part of the work force views productivity that way. Productivity means that somebody else will benefit from their efforts. The other guy will benefit at their expense. Higher productivity will mean "speed-up" for them, or they will be robotized right out of their jobs.

Hourly employees often have legitimate gripes, legitimate concerns; they are very fearful that instead of enhancing their job security, increased productivity will do away with their job security. Management has to make a commitment to the effect that this will not happen—that workers will not be penalized and lose their employment because of increased productivity.

Employees must understand that management is not talking about speed-up, management is not talking about working harder. Management is talking about working smarter, working more cooperatively, working more diligently, using creative talents. They have to be convinced, and only management integrity and openness can accomplish this.

The importance of each individual on the team has to be recognized. Communication must be carried on up and down vertically, horizontally, every which way.

Economic education has to be furthered.

Employee involvement techniques have to be worked out. QWL activities and financial reward systems flow together as in a confluence. These activities are mutually supportative.

One of the most significant QWL activities or processes that a company can undertake is to set up a financial participation program—with worker involvement—in a company.

My staff has put together in exhibit A some evidence that financial participation programs contribute to corporate profitability.

Seven studies have been made, to my knowledge—maybe there have been more—that point in this general direction that financial participation programs do contribute to increased productivity and corporate profitability.

Two of the studies were made by the Profit Sharing Research Foundation.

One study was made by a professor, Bion Howard, of the Graduate School of Management, Northwestern University.

Michael Conte and Arnold Tannenbaum at the University of Michigan have made a study of ESOP's.

Don Nightingale at Queen's University in Canada made a study of profit-sharing programs.

The ESOP Association of America studies ESOP programs.

The General Accounting Office (GAO) reported its findings to you earlier in these hearings.

While none of these studies "prove" the efficacy of profit sharing or productivity sharing, and/or employee stock ownership, they do establish a positive correlation between the existence of these programs and superior corporate performance. This should not come as a surprise. It makes sense that employees, individually and as a team, will more likely strive for excellence if they have a direct stake in the results.

Thoughtful union leaders are engaged in much soul-searching these days trying to envision their future role in society.

The adversarial role of unions may well be anachronistic. There is a time to fight and a time to cooperate. The inordinate cost of labor-management conflict will no longer be borne by consumers or by the public. The principal victims in the struggle are management and labor—the parties themselves—who suffer lost markets and jobs as conflict drives costs up, up, up. The only beneficiaries are overseas competitors.

Several industries in the United States are in deep financial trouble. Many companies are high-cost producers. Traumatic changes must take place or there companies and their unions will bite the dust.

In the automobile, airline, publishing, and rubber industries—to mention a few—profit-sharing proposals or stock proposals are being made to labor.

Management is saying that if labor is willing to share losses on the downside—through wage freezes or cuts, or COLA caps or COLA elimination—management will be willing to share profits with labor on the upside.

Never before have I seen so many companies willing to share profits they do not have.

This is an extraordinary development because normally profit-sharing programs are set up in financially sound, growing companies that really feel philosophically that employees are making a major contribution to the success of the company and should share in the profits.

We are witnessing a new phenomenon occur where companies with their backs to the wall are groping for an answer. However, I am very concerned that once the companies regain profitability after sharing with labor for 1 or 2 or 3 years, their pragmatic commitment will disintegrate.

Only a long-term philosophical commitment to sharing—based on the solid recognition that people do count—will keep the sharing/participative program going. Otherwise the program will fail. Sharing can not be a stop-gap measure.

One of the key ingredients in the Japanese success has been their flexible compensation program.

The Janpanese pay modest wages—for example, in the automobile industry around $11 an hour compared to U.S. rates at $18 to $20 an hour. They have moderate wages complemented by semiannual cash profit-sharing bonuses that may range from 2 to 8 months of pay. This flexibility automatically rewards labor on the upside and decreases total compensation on the downside.

During a recession the Japanese system automatically cuts back on flexible compensation—not in the $11 per hour but in the semiannual profit-sharing bonuses. They cut back on compensation; we cut back on people.

Walter Reuther, president of the UAW at the time, asserted that profit sharing was the only way for unions to get their full equity without creating inflationary pressures which undermine their own job security. Unions work against their own interests if they push too hard.

Further real economic gains can be achieved only if labor and management show a willingness to collaborate—to increase productivity and share efficiency gains.

In effect, I am recommending that we really take a look at this adversarial relationship. It must be dramatically changed toward a cooperative, collaborative relationship. We do not get needed support in our schools. Our schools do not teach labor-management cooperation; they teach management-labor conflict—how to resolve conflict, how to medicate, how to arbitrate, how to negotiate, how to fight. That do not teach labor and management how to work together toward mutually satisfying goals. That is a crying need in our country today.

Nobody has trained or taught people how to collaborate.

Mr. DYMALLY. May I interrupt for just a minute?

You hear our dialog with Mr. Straw about the adversarial relationship. Do you think it is possible for us to find a more appropriate word in order to eliminate what has developed as an adversarial relationship?

Mr. METZGER. Yes, I concur with you in your remarks to him.

I think we have to start working toward modes of accommodation in collective bargaining and encourage cooperative participation and information sharing between contracts as well.

I would just like to emphasize that ownership frequently goes hand-in-hand with profit sharing. In our industrial societies, ownership has always been concentrated in a few hands—under capitalism in a few private hands; under socialism/communism in a few bureaucratic political hands; or (under the Meidner proposal for Sweden) possibly in a few union hands.

We have an opportunity today to do something that has never been done before in the history of the world—to create a society where we do not have concentrated ownership, but diffused owership among millions of our people.

If technology is important in the production of wealth, and nobody can deny that, then it seems to me that technology, plant and equipment should be broadly owned.

Free enterprise capitalism can survive if it is a "sharing capitalism"—with broad numbers of our people having a direct stake in efficiency profits and in ownership of the companies for which they work.

Finally, I might indicate that individuals differ considerably in their motivations at different stages of their lives. Different incentive hierarchies should be developed to meet the diverse needs of employees. Some incentives should be short term, some long term, some stock, some cash, some psychic, some financial. The whole point is that management should share. It should share information, responsibility, opportunity for worker input, gains, and ownership. Management should shoot their organizations through from top to bottom with cohesive unitive incentives and create a climite in which their people will turn themselves on to high productivity. Thank you.

Mr. LUNDINE. Thank you.

[The prepared statement of Bert L. Metzger follows:]

IMPROVING PRODUCTIVITY AND THE QUALITY OF WORK LIFE THROUGH FINANCIAL PARTICIPATION PROGRAMS

by Bert L. Metzger

I am Bert Metzger, President of the Profit Sharing Research Foundation (PSRF) in Evanston, Illinois.

The Profit Sharing Research Foundation, as a non-profit 501(c)(3) publicly supported educational foundation, is dedicated to discovering and publishing facts about the experiences of companies with profit sharing, productivity sharing, employee stock ownership, and participative programs:

1) as a practical guide to those designing/operating such programs; and

2) to examine the role these programs can play in resolving critical socio-economic problems afflicting society today.

PSRF's primary job is to do the research and analytical work which business, labor, government, and academic communities need on sharing/participative systems as they bear upon motivation, productivity, inflation, employment security, labor-management relations, quality of work life, and retirement income.

I welcome the opportunity to speak to you this morning on the subject of "Improving Productivity and the Quality of Work Life through Financial Participation Programs."

THE DIFFERENCE IS IN THE SMALL INCREMENT OF EXTRA PERFORMANCE

Mr. Crawford H. Greenewalt, former chairman of the board of E. I. duPont, once said:

> The difference between the notably successful institution and one whose record is simply run-of-the-mill is seldom very great. It does not consist of brilliant and inspired flashed of genius--certainly not over a considerable period of time. The difference rather is in the small increment of extra performance diffused over a very large number of individuals at all levels of the organization.

Mr. Greenewalt went on to say:

> Give men the maximum of freedom, the maximum of incentive, and the achievements of the individual will be fused into the accomplishments of the institution.

The greatest challenge managers face today is to achieve that fusion, to create that unity of purpose between stockholders, management, and employees.

We must learn how to design our organizations so that technology may be advanced and human requirements satisfied simultaneously.

As John Gardner in his book, Self-Renewal, pointed out: "We must learn to make technology serve man not only in the end product but in the doing."

FRAGMENTED APPROACH TO MOTIVATION

One reason we have such great difficulty obtaining this small increment, achieving this fusion and unity of purpose is due to our fragmented approach to motivation.

We have organized our industrial corporations as "pyramids" from top to bottom in the interest of efficiency and then have in many ways thwarted this efficiency. We have not learned how to communicate very effectively up and down within this pyramid, and we are a long way from developing a common language.

But perhaps one of our most grievous faults is our approach to motivation. Either by design or default, a fragmented approach to motivation has evolved. Executives have been rewarded through salary plus profit-sensitive bonuses and stock options; salaried personnel through salary plus status plus fringe benefits (largely unrelated to performance); hourly employees by pay/benefits plus individual production bonuses; and stockholders through dividends and stock appreciation.

Thus, we have carefully stratified our corporate pyramids and have developed horizontal modes of motivating each stratum. We have driven artificial wedges between this group and that, and then wonder why alienation, lack of cohesion, and loss of employee identification with the firm plague our corporations.

NEED FOR COHESIVE INCENTIVES

What we vitally need today are cohesive incentives that:

1) cut vertically through the organization, pull the company together, and strengthen organizational bonds;

2) focus on the qualitative and creative aspects of work--on new ideas and more effective teamwork;

3) appeal not only to the financial needs but also to the social and ego-fulfillment needs of employees;

4) facilitate change, the introduction of new techniques, processes, equipment, and products; and

5) relate people to the common goal of improving organizational effectiveness.

In short, what we need today are cohesive incentives which can simultaneously unite and motivate all those contributing to corporate success.

Profit sharing programs are cohesive, unitative incentives because these programs focus the attention of all on a common target--increased profits--and then reward all with profit participation. The rewards of high profits and the penalties of low profits can be shared proportionately by all contributing groups. Mutually rewarding targets, a common language, and a new sense of employee involvement can emerge--if the plan is well designed and implemented.

IMPORTANCE OF PEOPLE AND PLANT IN THE PRODUCTIVITY EQUATION

Productivity is an extremely complex subject and most people do not even agree on how it should be defined--let alone increased.

In approaching the subject, we should be less concerned about productivity in the narrow sense--so many widgets per hour--and more concerned about productivity in the broad sense of enhancing organizational efficiency--i.e., the effectiveness with which people and plant deliver goods and services to the market.

The declining productivity rate in the United States over recent years is undoubtedly due to many factors. One of the most important factors, in my mind, is the under-utilization of the productive talent of our people.

Two sources work in unison to create wealth--i.e., man and machine. They are both important; they both count in the productivity equation.

We make a mistake if we excessively emphasize one or the other. Balance between the two factors is imperative. The only way to achieve high productivity and low unit cost is through a successful marriage between man and machine.

RAISING EMPLOYEES' WILL TO WORK

New York University issued a tome a while ago on Work, Productivity, and Job Satisfaction under a grant from the National Science Foundation. Out of all this theoretical and practical material, two paragraphs struck me as particularly important.

The key to having workers who are both satisfied and productive is motivation--i.e., arousing and maintaining employees' will to work effectively. Motivation is the key to having workers who are productive, not because they are coerced but because they are committed.

Of all the factors which help to create highly motivated/highly satisfied workers, the principal one seems to be that effective performance be recognized and rewarded--in whatever terms are meaningful to the individual, be it financial, psychological, or both.

Those two paragraphs say a lot. The key is motivation. It is up to management to arouse and maintain the employees' will to work efficiently. Excellent performance must be rewarded in terms meaningful to the employee--him or her, not the manager.

Let's face it. No one can motivate any other person. Motivation is an engine that the worker turns on inside himself. He turns on and maintains his own motivational machine. The most management can do is create a climate in which this kind of "turn-on" will occur.

This is where QWL, financial participation, and share ownership fit in--as a way to create a sharing climate in which excellence is recognized and rewarded financially and psychologically.

INCREASING PRODUCTIVITY THROUGH GAIN-SHARING PROGRAMS

There are a number of ways to achieve greater employee involvement and higher productivity. Compatible with direct worker participation in shop floor discussions through Quality of Work Life Committees or Quality Control Circles are gain-sharing plans, such as Improshare, Scanlon, Rucker, profit sharing (cash, deferred, or combination), and employee stock ownership programs (ESOPs).

No gain-sharing plan is perfect. Each has its own advantages and limitations.

A review of the characteristics of the most prominent types of gain-sharing plans should demonstrate that there is not "one best way" to share. There are several options (depending on the circumstances in the particular case) and plans frequently work well together "in tandem."

May I refer you to Exhibit "A" which describes bonus calculations under various gain-sharing programs:

Improsnare

Scanlon

Rucker

Profit sharing
(cash, deferred, combination)

Employee stock ownership
(leveraged ESOP)

GENERAL ACCOUNTING OFFICE (GAO) STUDY OF PRODUCTIVITY SHARING PROGRAMS

As a result of a study of 36 companies with productivity sharing plans, the U. S. General Accounting Office in March, 1981 reached certain conclusions and provided practical advice:

- Successful plans produce many benefits but gain-sharing plans should not be viewed as panaceas.
- Managers must devote time and effort to the plan.
- Information should be obtained on the significant features of the principal types of sharing plans.
- Counsel from firms with successful programs should be beneficial.
- A consultant might be hired to assist.
- Employees and the union should be advised on the plan--i.e., its features, mechanics of operation, and benefits.
- Employees should be assured that the bonuses/contributions generated are determined fairly and equitably.
- Periodic review and fair adjustment of formulas for new capital equipment and changes in product mix, if necessary, should be built into the plan.

CAUTIONS

Based on PSRF experience, not all financial participation programs succeed. They have worked remarkably well in many firms, fairly well in others, and not at all in some.

Programs have failed in the past because...

-- coverage was too limited to promote teamwork (the plan became divisive);

-- company contributions were discretionary and arbitrary (employees had little assurance that they would get their fair share if the business prospered);

-- companies shared too little to be significant, below the threshold for effective employee motivation;

-- companies shared too much, with too little left for reinvestment in new plant and equipment;

-- plan features were not kept in tune with changing employee and company needs;

-- plan was taken-for-granted (not communicated regularly and enthusiastically);

-- employees were kept "in the dark" (they did not "know the score" on an ongoing basis nor were they told how they could become better profit-makers).

Financial participation programs should not be used as a substitute for...

- competitive wages and customary fringe benefits;
- good working conditions;
- sound personnel practices (e.g., fair wage and salary administration, equitable treatment of employees, grievance resolution, training and development, promotion from within, and the like);
- competent management.

Financial participation is not a panacea; it will not solve all problems. However, it can help to create an atmosphere of cooperation in which problems can be solved, and also provides the incentive for their resolution.

CONDITIONS FOR SUCCESSFUL MOTIVATION

Specific ingredients are required to maximize incentives under financial participation programs.

- Commitment

  Commitment to the participative/sharing program must start at the top and permeate the entire organization. Top and middle management must support the program enthusiastically and visibly. A labor-management partnership must be fashioned and this takes effort, thought, and determination.

  The spirit of the sharing is even more important than the amount shared.

- Plan features designed to motivate

  Plan features should be designed to motivate, flexible enough to meet individual needs. We are moving away from plans with rigid provisions applying exactly in the same way to all participants irrespective of their individual circumstances.

  We are moving toward plans where the individual has more to say about how the plan will serve his needs now, ten years from now, twenty years from now, and just before retirement.

  If a participant can change the options in the plan to meet his changing needs, the plan is bound to be more meaningful to him and more of a motivator.

- Sharing productivity/profit gains

  Most hourly-paid employees believe that they do not derive any direct benefit from increasing productivity. They feel stockholders and managers benefit--the "other guy" benefits--but not themselves. In fact, wage employees are inclined to think that the other guy benefits at their expense. Employees believe that higher productivity means "speed-up" for them and will undermine, not strengthen, their employment security.

Managers must overcome these negative, but very legitimate, concerns among their employees. Managers must show their good faith by assuring workers that increased productivity will come from employees working smarter, not harder, that gains will be fairly shared, and that employment security will be enhanced.

- Importance of each member of the productive team

Everyone on the team has an important position to play or he should not be on the team. Management must reflect this conviction not only in words but in actions.

- Communication/economic education

The purpose and features of the plan must be understood and appreciated by participants. All appropriate media--the spoken word, the written word, audio-visual aids--should be employed to convey this message. But this is not enough.

Employees must perceive enough about the company to develop a close identification with it.

Once a year, the President of the United States gives a state-of-the-union message to the American people. Why should not corporate presidents deliver state-of-the-company messages several times a year to their employees?

There are many things that can be done. Managers must let their employees "know the score" on an ongoing basis...and give them a chance, a challenge, to improve the score.

Finally, communicate effectively about the economy, the free enterprise system, and what it means to have a profit/ownership stake in this system.

- Employee involvement

Employees at all levels may like the sharing program but the program will not motivate unless the worker feels that he or she, as an individual and as a member of the team, can have a positive effect on productivity. Each must perceive himself/herself having an impact.

They must know their efforts and ideas count. To achieve this, management must provide effective means for worker participation in product quality and productivity improvement.

QWL activities and financial reward programs flow into each other and reinforce each other. In fact, the initiation of a well-designed, communicated financial participation program might well be one of the most significant QWL processes that can be undertaken in a company.

SYSTEM INCENTIVE PROGRAMS

It is unfair to judge a system incentive or gain-sharing program by criteria used to evaluate an individual piecework incentive program.

A piecework program is a "stimulation" incentive. A stimulation incentive directly induces the isolated employee to work harder to increase his production and his bonus.

A system incentive motivates but in a different way; it motivates the individual as a member of the productive team. It is a "participation" incentive and increases productivity as a result of employee cooperation and involvement.

Participation incentives have as their objective to increase labor-management collaboration, to create employee attitudes favorable to the firm, to develop a community within the firm and integrate people into it. Participation bonuses also have the further objective of interesting employees in technological progress by giving them a share of the fruits of capital productivity.

Many companies have experienced the motivational power of system incentives.

Henry Coords, then president of Fisher-Price Toys, recently stated that

> Profit sharing is the best form of employee motivation and involvement....I am convinced that profit sharing with no production incentives is a greater motivation to productivity than is either individual or group production incentives.

Evidence that financial participation programs may contribute to corporate profitability is presented in Exhibit "B."

The critical ingredients for success are...integrity...conviction that people count... communication--no "credibility gap"...desire by all to make the program work.

UNIONS AND PROFIT SHARING

Union attitudes toward profit sharing in the U. S. historically have been hostile or indifferent. In the early days of business unionism, higher wages, better working conditions, and union security were chief labor goals. They wanted their gains "in the pay envelope." To a large extent, this is still true today. Union leaders were suspicious of profit sharing programs because they felt managements were using profit sharing to avoid paying decent wages, to keep the unions out, and/or to undermine collective bargaining.

Organized labor has gradually modified its position.

However, there is no universal union attitude toward profit sharing. Attitudes vary between individuals, unions, and levels (local or international). Attitudes depend a great deal on the particular experiences encountered by union people with specific profit sharing programs.

In the study of Profit Sharing in 38 Large Companies published by the Profit Sharing Research Foundation, twenty-four out of the thirty-eight companies were unionized to some extent.

Unionized employees participated in the profit sharing programs in nineteen out of the twenty-four companies. This included retail clerks, meat cutters, restaurant employees, grain millers, machinists, electrical workers, steel workers, teamsters, brewery workers, oil, chemical and atomic workers, and many others.

While many companies with unions share profits, most very large unionized companies do not.

Thoughtful union leaders are engaged in much soul-searching these days trying to envision their future role in society.

The adversarial role of unions may be anachronistic. There is a time to fight and a time to cooperate.. The inordinate cost of labor-management conflict will no longer be borne by consumers or society. The principal victims in the struggle--whether they recognize it or not--are the parties themselves (management and labor) who suffer lost markets and jobs as conflict drives costs up, up, up. Overseas competitors are the beneficiaries.

Several industries in the U. S. currently are in deep financial trouble. Many companies are high cost producers. Traumatic changes must take place or these companies and their unions will "bite the dust." In the automobile, airline, publishing, rubber industries--to mention a few--profit sharing proposals are being made to labor.

If labor is willing to share losses on the downside--through wage freezes or cuts, or COLA caps or COLA elimination--management will be willing to share profits with labor on the upside.

Never before have I seen so many companies willing to share profits they do not have.

This is an extraordinary development as most profit sharing plans historically have been implemented in financially sound, growing companies who wanted to share profits with employees who helped create them. Loss sharing coupled with profit sharing--initiated in companies with their "backs to the wall"--is a relatively new phenomenon and raises a host of questions.

One of the key ingredients in the Japanese success has been their "flexible compensation program" (modest wages complemented by semi-annual cash profit sharing bonuses normally amounting to from 2 to 8 months pay) which automatically rewards labor on the upside and decreases total compensation on the downside. During a recession, the Japanese cut back on compensation; we cut back on people.

Walter Reuther, when he was president of the United Automobile Workers (UAW), asserted that profit sharing was the only way for unions "to get their full equity" without creating inflationary pressures which undermine their own job security.

Further real economic gains may be achieved only if labor and management show a willingness to collaborate--to increase productivity and share efficiency gains. This will require enlightened leadership among both social partners.

BROADENING SHAREOWNERSHIP

Profit sharing and a stake in ownership often go hand in hand.

There is no natural law against the majority of employees in a capitalistic society being capitalists.

In all industrial societies, ownership has always been concentrated in the hands of a few--in a few private hands (under capitalism), or a few bureaucratic political hands (under communism/socialism), or (under the Meidner proposal for Sweden) possibly in a few union leader hands.

We have an opportunity today to do something that has never been done before in the history of the world--to create a society where we do not have concentrated ownership, but diffused ownership among millions of our people.

If technology is important in the production of wealth--and who can deny this--then it is essential that this technology be broadly owned.

Free enterprise capitalism can survive if it is a "sharing capitalism"--with broad numbers of our people having a direct stake in efficiency profits and in ownership of the companies for which they work.

A "sharing capitalism" can not only survive, but thrive.

HIERARCHY OF INCENTIVES

Under profit sharing, it is extremely helpful to set interim goals--i.e., specific targets employees can aim at--relating to such things as scrap ratios, absentee and turnover rates, production, sales, payroll to sales, and profit objectives. Publish and discuss performance-against-target data on a monthly/quarterly basis. Managers should let their people know how they are doing, and search ardently with them for ways to improve.

It is frequently advantageous to have other performance reward systems operative alongside deferred profit sharing. Permeate the organization with an incentive philosophy.

Individuals differ considerably. They respond to varying incentives even at different stages in their lives--e.g., some short-term, some long-term, some psychic, some financial, some stock, some cash. Different types of incentive hierarchies should be developed which complement/reinforce each other, and together meet the diverse motivational needs of people.

Different incentive hierarchies can be developed--individual incentive plans and profit sharing--Improshare plans at the departmental or product line level, and profit sharing at the plant level--Improshare, Scanlon, or Rucker plans at the plant level and profit sharing at the corporate level--cash profit sharing combined with an ESOP.

Managers should share gains, information, responsibility, opportunity for input, and (where feasible) ownership with their people. They should shoot organizations through with incentives from bottom to top and turn people on to high productivity.

CONCLUSION

Let me summarize. What are we not talking about today?

We are not talking about yesterday's problems. We are not talking about tomorrow's magic potions. We are not talking about a paternalistic system of giving the company away to the workers.

We are talking about creating a system which is participative and profit-oriented to serve the interests of all.

We are not talking about an anti-labor program nor an anti-management program. We are talking about a synergistic program beneficial to both.

We are not talking about a fringe benefit, a tax gimmick, or just a flexible way to fund a retirement program.

What are we talking about? We are talking about creating a...

-- cooperative ("win-win") relationship between capital, management, labor and consumer;

- -- flexible, noninflationary reward system directly linked to the economic productivity of the enterprise;
- -- cohesive unitative system approach to motivating individuals as individuals and members of a total group;
- -- saved (invested) component of compensation providing employees with a genuine ownership stake in their own companies and in firms across the land;
- -- ego involvement--creating among employees a sense of belonging, recognition, and importance through participation;
- -- human cybernetic system with goal orientation, communication, feed-back, and self-directed supportative employee performance.

The result of creating participative/sharing systems in our organizations should be a freer, more economically independent people who derive greater satisfaction (financial and psychic) from their jobs and contribute more to them.

Under this system, we should be able to solve the problems confronting us, and productivity, individuals, and companies should grow.

Success is not automatic. It requires a lot of work. Difficult, yes. Impossible, no.

We should be mindful of the words of Charles F. Kettering:

> Nothing ever built went up to touch the skies unless some man dreamed that it could, some man believed that it should, and some man willed that it must.

EXHIBIT "A"

IMPROSHARE PLAN

IMproved PROductivity through SHARing.

The Improshare plan is described and illustrated in the following simplified example:

A single product plant of 100 employees produced 26,000 units over a 26-week base period in which they worked a total of 104,000 hours. The average time to produce a unit was 4.0 hours.

$$\frac{104{,}000 \text{ hours}}{26{,}000 \text{ units}} = 4.0 \text{ hours per unit}$$

Suppose an Improshare plan is introduced under which the 4.0 hours per unit is accepted as standard and productivity gains (saved hours) are shared 50% - 50% between employees and management.

In a given week under the plan, 102 employees worked a total of 4,080 hours (102 times 40 hours) and produced 1,300 units.

The value of the output (standard hours earned) would be 1,300 units times 4.0 hours per unit = 5,200 hours.

1,300	units
X 4.0	standard hours per unit
5,200	standard hours earned

5,200	standard hours earned
-4,080	actual hours worked
1,120	gained hours

The gain would be 5,200 standard hours earned minus 4,080 actual hours worked equalling 1,120 gained hours, with half or 560 hours going to the employees.

Translated into incentive pay, this gain would amount to 560 hours divided by 4,080 actual hours worked equalling 13.7% productivity bonus per employee.

$$\frac{560 \text{ gained hours}}{4{,}080 \text{ actual hours worked}} = 13.7\% \text{ of pay}$$

Management would also gain 560 hours. Employees and management would have mutual interest in productivity gains in which they both share.

If plants have multiple product lines, standard hours per unit would have to be calculated for each product. In determining standard hours gained during a specific period, each product would be weighted by its volume.

Prepared by

PROFIT SHARING RESEARCH FOUNDATION
1718 Sherman Avenue
Evanston, IL 60201

SCANLON PLAN BONUS CALCULATION

Gross sales	$1,100,000
Less sales returns, allowances, discounts	25,000
Net sales	1,075,000
Add increase in inventory (at cost or selling price)	125,000
Sales value of production	$1,200,000

Allowed payroll costs (20 per cent of sales value of production)	$ 240,000
Actual payroll costs	210,000
Bonus pool	30,000
Company share (25%)	7,500
Employees share (75%)	22,500
Reserve for deficit months (25%)	5,625
Immediate distribution in cash (75%)	$ 16,875

Participating payroll	$ 168,750
Bonus percentage ($16,875 ÷ $168,750)	10%

RUCKER PLAN BONUS CALCULATION

The Rucker plan is based on value added by manufacture (sales less purchases) rather than sales value of production.

Before a program is begun, a "standard ratio" is developed from an analysis of prior history which establishes the break-even performance for incentive pay. For example, this might be the historic profile for a given plant:

Value Added per Dollar of Employee Compensation

1975	$2.67	1978	2.79
1976	2.73	1979	2.59
1977	2.61	1980	$2.65

"Par" is the average -- $2.673.

Incentive rewards are paid to all participants as a share of the improvement when actual results exceed this "standard."

Results for a future period might look as follows:

Wages paid	$ 80,000	
Benefit costs	20,000	
Total compensation	$100,000	
times productivity standard of	$ 2.673	
"Standard" production value		$267,300
Sales value actually produced	543,000	
less purchases	-249,000	
Value added by manufacture		$294,000
Gain over standard		$ 26,700
Company share ($1.673 ÷ $2.673) or 62.59%		$16,712
Employee share ($1.000 ÷ $2.673) or 37.41%		$ 9,988

One-fourth or one-third would normally go into a "Balancing Account" to offset potential deficit periods.

Three-fourths immediate cash bonus	$ 7,491	
Wages of eligible employees	76,482	
Bonus rate		9.8%

SAMPLE "PROFIT SHARING" FORMULAS FOR DETERMINING COMPANY CONTRIBUTIONS

Specified Percentage of Profits

- 30% of after-tax profits
  --with no prior reservation
- 22% of pre-tax profits
  --with no prior reservation
- 44% of after-tax profits
  --with a prior reservation of 5-1/4% return on net worth

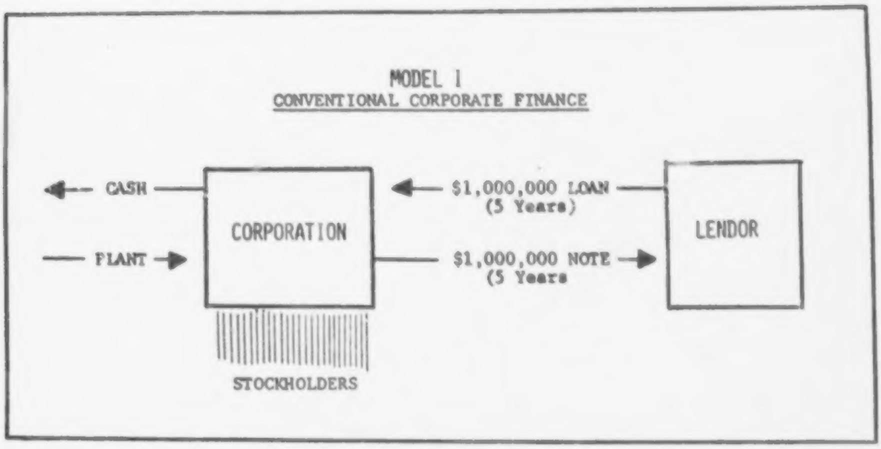
Sliding Scale Formulas

- 8% of first $100,000,000 of pre-tax profits, plus
  10% of the next $50,000,000, plus
  15% of any profits over $150,000,000
- As ROA (return on assets figure -- i.e., consolidated income before taxes divided by average total assets) rises, the company contribution as a percentage of participating compensation increases:

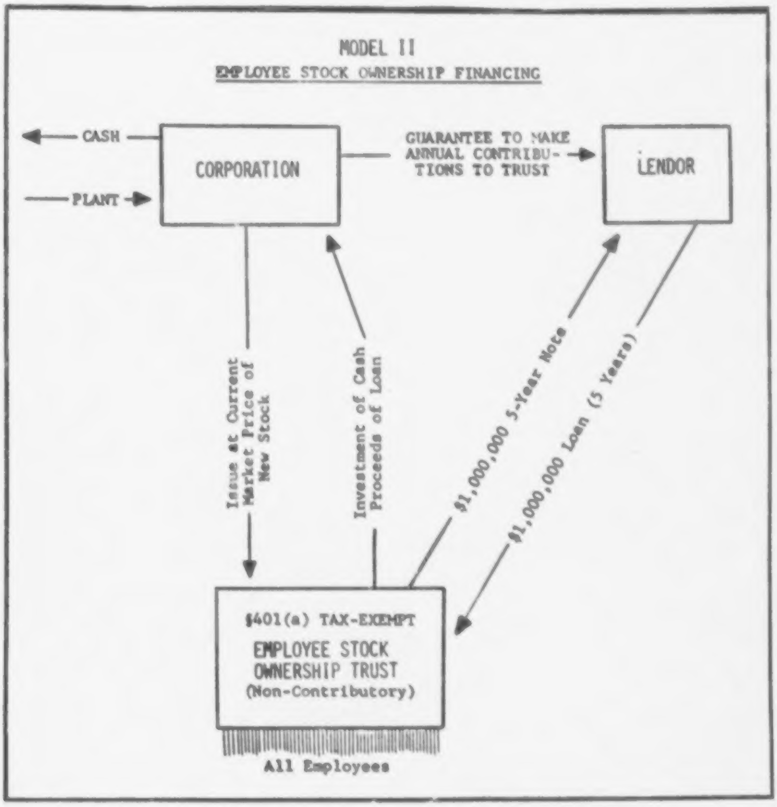
ROA %	Contribution % to Retirement Account	Contribution % to Optional Account	Total Contribution Percentage
11.5 or less	5 %	0 %	5 %
12	5	.4	5.4
13	5	1.3	6.3
14	5	2.2	7.2
15	5.3	2.8	8.10
16	5.75	3.25	9.00
17	6.15	3.65	9.80
18	6.55	4.05	10.60
19	6.95	4.45	11.40
20	7.35	4.85	12.20
21	7.75	5.25	13.00
22	8.15	5.65	13.80
23	8.55	6.05	14.60
23.5 or more	8.75%	6.25%	15.00%

- Company contributions to profit sharing as a percentage of pay rises as return on assets (ROA) and people effectiveness index (PEI) go up:

ROA Profit after taxes / Average Assets	PEI Net sales billed / Payroll				
	2.0	2.5	3.0	4.0	5.0+
3.5%	0	0	0	0	0
4.0	0	0	0	0	1.0
4.5	0	0	0	0	2.0
5.0	0	0	0	1.0	3.0
5.5	0	0	0	2.0	4.0
6.0	0	0	1.0	3.0	5.0
6.5	0	1.0	2.0	4.0	6.0
7.0	1.0	2.0	3.0	5.0	7.0
8.0	3.0	4.0	5.0	7.0	9.0
9.0	4.0	5.0	6.0	8.0	10.0
10.0	5.0	6.0	7.0	9.0	11.0
11.0	5.5	6.5	7.5	9.5	11.5
12.0	6.0	7.0	8.0	10.0	12.0
13.0	7.0	8.0	9.0	11.0	13.0
14.0	8.0	9.0	10.0	12.0	14.0
15.0	10.0	11.0	12.0	14.0	16.0
16.0	12.0	13.0	14.0	16.0	18.0
17.0% and above	14.0	15.0	16.0	18.0	20.0



MODEL I
CONVENTIONAL CORPORATE FINANCE



MODEL II
EMPLOYEE STOCK OWNERSHIP FINANCING

CASH
PLANT
CORPORATION
GUARANTEE TO MAKE ANNUAL CONTRIBUTIONS TO TRUST
LENDOR
Issue at Current Market Price of New Stock
Investment of Cash Proceeds of Loan
$1,000,000 5-Year Note
$1,000,000 Loan (5 Years)
§401(a) TAX-EXEMPT
EMPLOYEE STOCK OWNERSHIP TRUST
(Non-Contributory)
All Employees

EXHIBIT "B"

EVIDENCE THAT FINANCIAL PARTICIPATION PROGRAMS CONTRIBUTE TO CORPORATE PROFITABILITY

A frequently voiced feeling about profit sharing is that such programs are unfair to stockholders--i.e., if labor gets more, stockholders get less.

In order to evaluate the incentive impact of profit sharing and to measure the effects of such programs on labor and stockholder interests, the Profit Sharing Research Foundation compared the financial performance of a group of large department store chains with profit sharing against a similar group without profit sharing over the period 1952-1969.[1]

The profit sharers outperformed the non profit sharers (based on growth since 1952) by 35% on sales, 47% on net worth, 80% on company earnings per employee, 88% on earnings per share, and 97% on market price per share. Employment in companies with broad coverage profit sharing programs increased 116% over the period.

Other studies of more recent vintage point in the same direction.

Bion Howard, of the Graduate School of Management, Northwestern University, studied the financial performance of profit sharing companies in six industries.[2] Sixteen comparisons were made for each industry--i.e., operating ratios and growth measures. The results revealed that the performance of the profit sharing companies was clearly superior to the non profit sharers for the six industries as a group. However, the superiority of the profit sharers lay in their *level* of performance and not in their *trend* (which tended to run parallel to that of non profit sharing companies). The profit sharers were above average in two-thirds of the cases and below average in less than one-fifth.

Michael Conte and Arnold S. Tannenbaum, of the Survey Research Center, Institute for Social Research, The University of Michigan, in a study of 98 firms, found that employee ownership, in one form or another, may be associated with better employee attitudes toward the job and higher productivity and profitability than comparable sized companies in their respective industries.[3]

Donald V. Nightingale, Associate Professor, School of Business, Queen's University at Kingston, examined 83 firms with profit sharing, using a 124-item questionnaire.[4] Because most of the firms in the sample were small and privately held, documented evidence was not available from audited statements for return on invested capital, growth in sales, and the like. However, executives were asked to evaluate the effectiveness of their profit sharing plans. Over-all, profit sharing was rated as most effective in attracting and holding desirable employees, followed sequentially by providing economic security for employees, increasing productivity, improving teamwork and cooperation, rewarding individuals, giving employees a better understanding of factors entering into business success, and facilitating the introduction of new plant and equipment. Sixty-four per cent of the respondents reported that turnover in their companies is lower than their industry average. Only 6% reported higher than average turnover rates. Executives also reported high levels of employee satisfaction with their profit sharing plans.

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[1] Metzger, Bert L. and Colletti, Jerome A., *Does Profit Sharing Pay?* Evanston, Ill., Profit Sharing Research Foundation, 1971.

[2] Howard, Bion B. *A Study of the Financial Significance of Profit Sharing*, 1958-1977, Chicago, Ill., Profit Sharing Council of America, 1979.

[3] Conte, Michael and Tannenbaum, Arnold S. "Employee-owned Companies: Is the Difference Measurable?" *Monthly Labor Review*, July, 1978.

[4] Nightingale, Donald V., "Does Profit Sharing Really Make Any Difference?" Ottawa, The Conference Board in Canada, January 17, 1980.

A survey of 72 companies with ESOPs (Employee Stock Ownership Plans) by The ESOP Association of America showed significant corporate gains post-ESOP compared with pre-ESOP.[5]

Profit Sharing Research Foundation in its study, Profit Sharing in 38 Large Companies, found that 23 profit sharing industrials outperformed Fortune's 500 largest industrials, and 10 profit sharing retailers achieved higher results than Fortune's 41 retailers on measures of return on sales and return on equity.[6]

The General Accounting Office (GAO) study of productivity sharing programs (including only Improshare, Scanlon, and Rucker plans) recommended that serious consideration be given to such plans as a means of stimulating productivity performance, enhancing their competitive advantage, increasing monetary benefits for employees, and reducing inflationary pressures. Firms that provided financial information on plan results realized average savings of 17% in work force cost. Other benefits included improved labor/management relations, reduced absenteeism and turnover, and fewer grievances.[7]

While none of these studies "prove" the efficacy of profit sharing, productivity sharing, and/or employee stock ownership, they do establish positive correlations between system incentive programs and superior corporate performance. This should not come as a surprise. It makes sense that employees, individually and as a team, will more likely strive for excellence if they have a direct stake in the results.

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[5] "The Performance of ESOP Companies," San Francisco, Calif., The ESOP Association of America Newsletter, September, 1979.

[6] Metzger, "Evidence of Superior Performance," in Profit Sharing in 38 Large Companies, Evanston, Ill., Profit Sharing Research Foundation, 1978.

[7] U. S. General Accounting Office, Productivity Sharing Programs: Can They Contribute to Productivity Improvement? Washington, D. C., GAO, 1981.

Mr. LUNDINE. As long as you have concluded commenting on the labor-union point I'd like to ask you if it's not your observation that the various gains-sharing systems have really contributed to improved performance more often in nonunion atmosphere. I mean, not to be critical, but for example you give one example that I could see in your paper—Fisher-Price Toys. I happen to know that's a nonunion.

In your testimony today you gave another one of Texas Instruments—largely nonunion anyway.

Mr. METZGER. Yes.

Mr. LUNDINE. Can you make an observation whether these gains-sharings programs have worked in union as well as nonunion or any generalization about the contracts?

Mr. METZGER. Yes, they have and they probably will make a greater contribution in the future. We can go down a list, of companies that have sharing programs that are unionized. This is true whether we are talking about Improshare Scanlon or Rucker profit-sharing plans.

For example, Zenith Radio Corp. is unionized, Xerox Corp. is unionized, and these have broad coverage gains-sharing systems.

We made a study of 38 large profit-sharing companies in the country—24 of those 38 were unionized to some extent and 19 out of the 24 covered their unionized employees in their sharing programs.

Mr. LUNDINE. Did you notice any difference between the success in union and nonunion companies?

Mr. METZGER. No; I have never really made an analysis that way. I have noticed that plans have failed in both environments, and plans have succeeded in both environments.

Mr. LUNDINE. You talked about the lack of respect to workers many managers have. How do we change that?

Mr. METZGER. Well, the key is education—that disturbs me a great deal. We have been historically acclimated to learn how to be a good pugilist in the collective-bargaining arena but not a collaborator. I don't know—basically that role should be taken on both by the union and by the company, if for no other reason than survival today.

I also suspect that the Government could have a constructive role in that educational process.

Mr. LUNDINE. Early in your testimony you were talking about how executives get paid on performance. I am a little bit worried about the quality of working life for executives. All we ever talk about is the blue-collar worker and their attitudes about their job. It seems to me that maybe some executives want something more than just bonuses if they produce.

And I guess as a consultant and an observer of the United States private enterprise scene I ask you, do you believe that serious attention has to be paid to the quality-of-work-life principles in management employees, including high-level management employees as well as production workers?

Mr. METZGER. My answer would be very definitely yes. You see people today out on the golf course—they're never the executives. Now they can't afford it. It's the hourly rated people who are out on the golf courses, and the executives are working hard on a 60-hour week.

Mr. LUNDINE. If you would put Congressmen in the categories of executives I would second that.

Mr. METZGER. If I had said that you would have thought my testimony was biased.

I also believe that management might find their jobs somewhat easier if the employees all had a stake in the results and did all they could to make the operation run smoothly. Maybe the executives wouldn't have so many knots in their stomach.

Mr. LUNDINE. Well, we don't want to transfer the ulcers from the management down to the teamwork-involved workers, but I think we also have to give some consideration to the quality of work life in management.

Mr. METZGER. I do, too.

Mr. LUNDINE. Lastly, since Mr. Brown had to leave I'll be philosophical—he usually contributes that on this subcommittee.

You quoted John Gardner on page 1 of your testimony and I won't repeat it because it's there for anyone to see. My question is, how does profit-sharing contribute or does it contribute to better adapting new technology to the need of the worker as well as contributing to improved performance?

Mr. METZGER. Well, if the worker has a stake in improved results and if technology helps contribute to improved results and if the management is wise enough to consult the worker before the new technology is introduced (and more and more firms are actually having some of the workers who will work on the machines go out as part of their procurement team to view the various machines that are available and to write up their advantages and limitations and help with the installation) then I think you end up with a much greater readiness among the people who work with these machines to accept the equipment, to be trained on it quickly and get it on line.

I know of cases where the workers have criticized management because they got the piece of equipment there and it has taken them too long to get on line. They want the equipment on line because they have a benefit from it.

Mr. LUNDINE. That is an outstanding bridge of the gap to our next witness.

Mr. RHEEM. One brief question, Mr. Metzger.

What do you feel would be an appropriate Federal role that might assist these profit-sharing plans in business? Is there something the Federal Government can do to encourage the utilization of profit-sharing plans?

Mr. METZGER. I'd like to see most of it done in the private sector. I feel Government can, perhaps, have a role in the incentive compensation area, if appropriate, and also perhaps in creating a climate of research and education which might go on in the country.

I feel they can show leadership and help create an atmosphere in which these programs can go forward, but they should not be intrusive.

Mr. RHEEM. Thank you.

Mr. LUNDINE. Thank you very much.

The next witness is William Koch, Assistant Chief of the System Design and Integration Division of the Office of Systems Engineering Management, at FAA.

Again, Mr. Koch, your entire testimony will be made a part of the record. You may proceed as you wish.

[The biographical sketch of Mr. Koch follows:]

Mr. William H. Koch is the Assistant Chief of the System Design and Integration Division, of the Office of Systems Engineering Management, FAA.

Prior to his current assignment, Mr. Koch was Chief, Simulation and Analysis Division, at the Federal Aviation Administration Technical Center, Atlantic City, New Jersey, where he directed experimentation, simulation, and test and evaluation programs in the area of air traffic control automation and improvement. Prior to his employment with the Federal Aviation Administration (Department of Transportation), he was associated with Melpar, Inc., of Falls Church, Virginia (1955-1959), where he worked on battlefield surveillance system development and test.

Mr. Koch holds a BSEE from the University of Connecticut, and has done graduate work at both the University of Virginia and George Washington University. He is listed in "Who's Who in the East," and is a member of the Operations Research Society of America and the Transportation Science Section of that group. He is also a member of AIAA (American Institute of Aeronautics and Astronautics).

Mr. Koch was born in New Haven, Connecticut, on August 9, 1933, and is married to Joyce Anne Corbett, of Front Royal, Virginia. The Koch's have three children and reside in West Springfield, Virginia.

STATEMENT OF WILLIAM H. KOCH, ASSISTANT CHIEF, SYSTEM DESIGN AND INTEGRATION DIVISION, OFFICE OF SYSTEMS ENGINEERING MANAGEMENT, FEDERAL AVIATION ADMINISTRATION

Mr. Koch. Thank you very much. I welcome the opportunity to appear here today to discuss our demonstration project which is the field impact evaluation of ETABS.

Now what I think what might be helpful is I have got a couple of pictures here.

We all know what an ETABS is if we see one.

Mr. Lundine. Yes?

Mr. Koch. This is the current end route operating position for the controllers in our national air space system. This is what they use today. There are about 30 of these in each of—like 20 centers, so there is a large family of these fairly sophisitcated systems.

The particular area to the right is the flight strip tabular display base, which are the things under question. This is where we post the flight strips, the paper strips, the paper strips that show the route of flight, their time-over effects, and their altitude. This was really the first piece of air traffic control separation that went in the early 1940's.

The ETABS system will replace all that paper processing with a couple of TV screens and—I was up at Harvard at the Kennedy School for Christmas and Dick Walton observed these. This is very similar to word processing as opposed to a typewriter and paper. It has the same characteristics. It's a simplification but that is kind of the way it is.

The project focused on the interaction of human organizational needs with the introduction of new technology in the workplace. My involvement in the area of potential work force impact related to the introduction of new technology began in 1977 when I served on an agency task group charged with answering the question: How can the assessment of human/technical system interface be improved to insure that the introduction of new technology in the air traffic control system maximizes efficiency and productivity?

During the course of the task group's activity I focused on how the group was assessing new technology and the ways in which they addressed work force impact issues while at the same time seeking to maximize system performance.

Out of this came a concept of sensitivity assessment—to identify the impact of new technology introduction and means by which negative impact could be minimized and system effectiveness maximized. We ran into the same problem that one of the other witnesses referred to earlier—the name was later changed to field impact assessment to avoid confusion with sensitivity training or "T" groups—which this clearly was not.

The ETABS, which represented an introduction of new technology, was selected as a vehicle to test the concept of doing a field impact evaluation. The most innovative aspect of this work was its application at the front end of the design and development effort rather than during, or subsequent to, field implementation.

Since installation of this new system is not scheduled until the mid-1980's, we cannot fully assess the extent or magnitude of the impact of the project. However, subjective evaluations by both development and field operations managers have identified positive impacts on both the quality of the system design and on acceptance attitudes of the field organization and work force.

As Neal Blake, Deputy Associate Administrator for Engineering and Development, said in a recent speech before an Air Traffic Control symposium:

> Over the last 26 years, the air traffic control system has evolved from a "manual" control system based primarily on procedural separation techniques to an automation-aided system where many of the routine tasks have been taken over by computers. Radar control procedures form the basis for aircraft separation throughout most of the nation's airspace.
>
> During the late sixties and early seventies computers were installed in the domestic centers and the top terminal facilities. A current program will result in installation of a lower capability automated system at a number of additional lower density radar terminals. Our current major system development programs will result in automation of some of the decision-making functions associated with aircraft separation assurance and metering, sequencing, and spacing of aircraft during the 1980's.

Mr. Blake's remarks leave no doubt as to the FAA's commitment to the application of automation and new technology in the evolution of our national airspace system.

Thus, the need to consider human and organizational concerns engendered by the continuing advance of technology application is real.

One aspect to be considered is the rapid and uneven introduction of technology into what has been a traditionally human-operated system of aviation services. This produces impact on both the technical system of equipment and the human systems which operate with the technical system.

The need for a detailed, comprehensive, and specific technique which could be used to evaluate alternative technical approaches and assess attendant work force impacts was clear. Since consideration of work force impacts and their resolution, independent of other system parameters such as safety, cost, capacity, service to user, et cetera, could result in idealistic, cost-inefficient, or capacity-inhibiting recommendations, the scope of our project was expanded to include all system parameters which have a relationship to work force impact considerations.

Thus, for example, if a technological improvement or change was proposed which appeared to have major negative work force impact, it would not be accepted or rejected without carefully considering its contribution to safety, capacity or other such benefit. Rather, some sort of trade-off between the two diverging impacts would be sought in an effort to maximize the positive contribution while minimizing and fully understanding the negative features.

The selection of ETABS as the trial vehicle for a field impact assessment was based on several factors.

First, while the program had been entered into the formal departmental systems acquisition management process, key decision points were still several years in the future. Thus, real impact on the program should be possible.

Second, while the technology was new, the basic function would remain the same—much as a CRT terminal word processor replaces paper and a typewriter.

Third, the extent of the change was organizationally confined, clearly identifiable, and would not be apparent to users of the national airspace system outside the FAA.

Finally, there was available a reasonable quantity and firmness of documentation on the ETABS system; there was no apparent preexisting organizational or work force hostility to the change, and the program manager was receptive to the notion of involving the field work force and organization in his development program.

The structure, organization, and operation of the field impact evaluation process made use of a diagonal slice group selection and operation concept.

Now what I would like to do here is I am going to skip from page 5 to page 14. I have taken the liberty to include a considerable amount of detail on the diagonal slice since I think it's a concept that evolved which is very useful. I do want to just quickly describe what our team was—who they were and how was it.

The only difference in diagonal slice versus vertical slice, which a couple of the other witnesses mentioned, is that nobody's boss is in the same group. That makes it easier for everybody to relate to everybody else as equal.

On the ETABS team we had 10 people. We had five from the air traffic control side of the house, a controller from the Boston Center; we had a team supervisor from the Kansas City Center; we had a data systems officer who is the one at the facility who takes care of all the computer software. He's from Seattle. We had a facility chief from the Indianapolis Center; we had a branch chief from the Rocky Mountain regional office in Denver. So we had geographical dispersion as well as organizational dispersion of about five supervisory levels, plus four, plus a controller.

On the engineering side, the guys that maintain the system, we had a technician from the Cleveland Center, a computer technician; we had an assistant system engineer from Palmdale, an assistant engineer from Houston, a sector manager from Denver, and a branch chief from the Atlanta regional office, the Southern region. So that was our team.

Mr. LUNDINE. Can I interrupt at that point?

I understood correctly that the bottom echelon in that organization chart did include the controller, the actual person who was using the equipment?

Mr. KOCH. The guy at the controls, yes.

As a member of the work force.

Mr. LUNDINE. And it also included the engineer or whatever title the person has who would fix it if it was broke?

Mr. KOCH. Yes.

We were focusing on the organization because at every level people have problems.

Anyway, I'll skip to page 14.

The process—now using this team—the process of the ETABS field impact evaluation consisted of four major elements: impact assessment, impact quantification, alternative development, and recommendations and conclusions.

Several additional supporting activities were included such as team-building exercises, technical education of the team—regarding the ETABS system—and team maintenance functions. A model is shown in figure 3—of the whole process.

The 6- to 8-week interval between team meetings should be noted. This interval provided an opportunity for each team member to interact with his colleagues at his home facility in a real world setting to form and confirm impressions and perceptions of impact.

This interaction or homework provided both an increased base and credibility for impact assessments and a broadened spectrum of perceived participation on the part of the field organizations and workers.

One difficulty in conducting a field impact assessment of a major program while in the design and development stage is the normally long period of time between the submission of an impact report and the field implementation phase of the program. The field people making the input have a valid concern as to whether their suggestions and recommendations for change have been heeded or filed without action.

Interestingly enough, the ETABS team included the recommendation for a follow-on tracking and reporting mechanism in their final report.

We plan to reconvene the team at our technical center in Atlantic City sometime early next year, after the delivery of the ETABS engineering model. This will provide a first review of both the validity of the impact assessment and solution recommendation report and an appraisal of the degree to which the recommendations have been incorporated and the negative impacts relieved or aggravated.

Results of the demonstration project appear in several general areas. The first is in the design and development of the ETABS engineering model. There have been several improvements in the design.

The second is in the area of field participation and acceptance of system change. In a letter to the Deputy Administrator dated October 24, 1979, discussing the field impact evaluation process, the Director of the Great Lakes Region said:

> The field impact evaluation method is an excellent vehicle for pinpointing potential problems prior to implementation of a major system change.
>
> Field input is an absolute necessity on any major change or research and development project. The recommendations of the people who will use a new system must be considered during its development. The benefits are simply that there is much less chance of something being overlooked and the field gains a valuable resource. The diagonal slice concept assures that the field input from all those affected will be received and considered. Technology assessment provides an ideal structure for gathering and presenting their recommendations.

The third outcome is a recognition by the engineering and development organization of the value of the process in producing a better product. In a letter dated November 20, 1979, to the Director of the Great Lakes Region, the Director of the Systems Research and Development Service said:

> It was encouraging to receive your very positive endorsement of the field impact evaluation process as applied to the electronic tabular display subsystem. The ETABS Program Manager shares your view of the benefits of the process and will follow the recommendations of the evaluation report to the maximum extent allowable within the terms of the development contract.

> The ETABS field impact evaluation report has been briefed to a large number of top level FAA managers involved with development and implementation of future systems. They now recognize the field impact evaluation method as an important new tool which can be applied during the development process to avoid future problems. Timing of the impact evaluation within the life cycle of a program, as well as the appropriate selection of the field personnel, appears to be the key to success.

Subsequent to the completion of the project—that was really in 1980—an introductory seminar on field impact evaluation was prepared and presented to program managers. It focused on the key role a program manager plays in deciding if a field impact evaluation of his program is desirable and cost-beneficial and if so, resolving the crucial issue of when to do it.

Regarding the question of should it be done, the answer is "Yes," if:

The project has trouble getting a clear and consistent statement of operational requirements,

The project needs early appraisal of design approach,

Implementation will have broad effects on field operations, procedures, maintenance, and training,

The program will need field involvement in later stages of the program, and

Other major FAA elements need to be aware of program dimensions—to help their advanced planning.

As for timing, the answer is, do it when:

The concept is developed far enough that it can be demonstrated, not just talked about,

The design is not so firm that it can't be changed without major cost and schedule impacts.

Specifically this is between the exploratory development and engineering model development.

Additionally, the program manager is an essential resource to the field impact evaluation team. He must support the team's proceedings. He can expect to invest significant time and effort in the activity.

His role in providing this support is not to defend or sell a particular program. That's very important. Rather, it is to:

Explain the program—its background, its requirements, expected benefits, risks, and status;

He is to provide staff expertise throughout;

Arrange for visits and demonstrations, and

Critique conclusions and final report.

He further must be as responsive as possible.

He can expect: reinforcement and support, challenges, questions, suggestions for change,

He should provide feedback to field impact evaluation as the program progresses.

The conclusions of the seminar:

For selected projects field impact evaluation is a unique and important tool;

It is costly and time-consuming;

Its recommendations and observations must be taken seriously.

Now turning to the subject of needed research and future work, from my observation after running the ETABS project, I believe researchers need to focus on achieving a better understanding and quantification of the connection between system performance or productivity and human attitudes and behaviors. The ability to identify specific results should enhance opportunities for the application of socio-technical design and implementation projects.

Additional work is also required in the area of organizational placement and integration of socio-technical projects. Credibility, participation, and acceptance is greatly affected by where and how in the organization the function is placed and conducted.

Finally, we need a broader and tighter coupling between theory and concept development activities and field implementation and application activities. These hearings provide a very positive step in support of such an improvement. Support and assistance in the area of documentation, dissemination and discussion of project activities will assist in developing answers to the question of how to design and manage new technology so as to increase productivity and develop human resources.

Mr. Chairman, that concludes my prepared statement. At this time, I would be pleased to respond to any questions you might have.

[The prepared statement of William H. Koch follows:]

STATEMENT OF MR. WILLIAM H. KOCH, ASSISTANT CHIEF, SYSTEM DESIGN AND INTEGRATION DIVISION, OFFICE OF SYSTEMS ENGINEERING MANAGEMENT, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY, CONCERNING "THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY." SEPTEMBER 15, 1981

I WELCOME THE OPPORTUNITY TO APPEAR BEFORE YOU TODAY TO DISCUSS OUR DEMONSTRATION PROJECT, "FIELD IMPACT EVALUATION OF THE ELECTRONIC TABULAR DISPLAY SYSTEM." THIS PROJECT FOCUSED ON THE INTERACTION OF HUMAN AND ORGANIZATIONAL NEEDS WITH THE INTRODUCTION OF NEW TECHNOLOGY IN THE WORKPLACE. MY INVOLVEMENT IN THE AREA OF POTENTIAL WORK FORCE IMPACT RELATED TO THE INTRODUCTION OF NEW TECHNOLOGY BEGAN IN 1977 WHEN I SERVED ON AN AGENCY TASK GROUP CHARGED WITH ANSWERING THE QUESTION: HOW CAN THE ASSESSMENT OF HUMAN/TECHNICAL SYSTEM INTERFACE BE IMPROVED TO ENSURE THAT THE INTRODUCTION OF NEW TECHNOLOGY IN THE AIR TRAFFIC CONTROL SYSTEM MAXIMIZES EFFICIENCY AND PRODUCTIVITY? DURING THE COURSE OF THE TASK GROUP'S ACTIVITY, I FOCUSED ON HOW THE GROUP WAS ASSESSING NEW TECHNOLOGY AND THE WAYS IN WHICH THEY ADDRESSED WORK FORCE IMPACT ISSUES WHILE AT THE SAME TIME SEEKING TO MAXIMIZE SYSTEM PERFORMANCE. OUT OF THIS CAME A CONCEPT OF SENSITIVITY ASSESSMENT (TO IDENTIFY THE IMPACT OF NEW TECHNOLOGY INTRODUCTION AND MEANS BY WHICH NEGATIVE IMPACT COULD BE MINIMIZED AND SYSTEM EFFECTIVENESS MAXIMIZED). THE NAME WAS LATER CHANGED TO FIELD IMPACT ASSESSMENT TO AVOID ANY CONFUSION WITH SENSITIVITY TRAINING OR "T" GROUPS.

THE ETABS SYSTEM, WHICH REPRESENTED AN INTRODUCTION OF NEW TECHNOLOGY, WAS SELECTED AS A VEHICLE TO TEST THE CONCEPT OF DOING A FIELD IMPACT EVALUATION. THE MOST INNOVATIVE ASPECT OF THIS WORK WAS ITS APPLICATION AT THE FRONT END OF THE DESIGN AND DEVELOPMENT EFFORT RATHER THAN DURING OR SUBSEQUENT TO FIELD IMPLEMENTATION. SINCE INSTALLATION OF THIS NEW SYSTEM IS NOT SCHEDULED UNTIL THE MID-1980'S, WE CANNOT FULLY ASSESS THE EXTENT OR MAGNITUDE OF THE IMPACT OF THE PROJECT. HOWEVER, SUBJECTIVE EVALUATIONS BY BOTH DEVELOPMENT AND FIELD OPERATIONS MANAGERS HAVE IDENTIFIED POSITIVE IMPACTS ON THE QUALITY OF THE SYSTEM DESIGN AND ON ACCEPTANCE ATTITUDES OF THE FIELD ORGANIZATION AND WORK FORCE.

AS NEAL BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING AND DEVELOPMENT, SAID IN A RECENT SPEECH BEFORE AN AIR TRAFFIC CONTROL SYMPOSIUM:

> "OVER THE LAST 25 YEARS, THE AIR TRAFFIC CONTROL SYSTEM HAS EVOLVED FROM A "MANUAL" CONTROL SYSTEM BASED PRIMARILY ON PROCEDURAL SEPARATION TECHNIQUES TO AN AUTOMATION-AIDED SYSTEM WHERE MANY OF THE ROUTINE TASKS HAVE BEEN TAKEN OVER BY COMPUTERS. RADAR CONTROL PROCEDURES FORM THE BASIS FOR AIRCRAFT SEPARATION THROUGHOUT MOST OF THE NATION'S AIRSPACE.
>
> DURING THE LATE 1960'S AND EARLY 1970'S, COMPUTERS WERE INSTALLED IN THE DOMESTIC CENTERS AND THE TOP TERMINAL FACILITIES. A

CURRENT PROGRAM WILL RESULT IN INSTALLATION OF A LOWER CAPABILITY AUTOMATED SYSTEM AT A NUMBER OF ADDITIONAL LOWER DENSITY RADAR TERMINALS. OUR CURRENT MAJOR SYSTEM DEVELOPMENT PROGRAMS WILL RESULT IN AUTOMATION OF SOME OF THE DECISIONMAKING FUNCTIONS ASSOCIATED WITH AIRCRAFT SEPARATION ASSURANCE AND METERING, SEQUENCING, AND SPACING OF AIRCRAFT DURING THE 1980'S."

MR. BLAKE'S REMARKS LEAVE NO DOUBT AS TO THE FAA'S COMMITMENT TO THE APPLICATION OF AUTOMATION AND NEW TECHNOLOGY IN THE EVOLUTION OF OUR NATIONAL AIRSPACE SYSTEM. THUS, THE NEED TO CONSIDER HUMAN AND ORGANIZATIONAL CONCERNS ENGENDERED BY THE CONTINUING ADVANCE OF TECHNOLOGY APPLICATION IS REAL.

ONE ASPECT TO BE CONSIDERED IS THE RAPID AND UNEVEN INTRODUCTION OF TECHNOLOGY INTO WHAT HAS BEEN A TRADITIONALLY HUMAN-OPERATED SYSTEM OF AVIATION SERVICES. THIS PRODUCES IMPACT ON BOTH THE TECHNICAL SYSTEM OF EQUIPMENT AND THE HUMAN SYSTEMS WHICH OPERATE WITH THE TECHNICAL SYSTEM.

THE NEED FOR A DETAILED, COMPREHENSIVE, AND SPECIFIC TECHNIQUE WHICH COULD BE USED TO EVALUATE ALTERNATIVE TECHNICAL APPROACHES AND ASSESS ATTENDANT WORK FORCE IMPACTS WAS CLEAR. SINCE CONSIDERATION OF WORK FORCE IMPACTS AND THEIR RESOLUTION, INDEPENDENT OF OTHER SYSTEM PARAMETERS (SAFETY, COST, CAPACITY, SERVICE TO USER, ETC.) COULD RESULT IN IDEALISTIC, COST-INEFFICIENT, OR CAPACITY-INHIBITING

RECOMMENDATIONS, THE SCOPE OF THE PROJECT WAS EXPANDED TO INCLUDE ALL SYSTEM PARAMETERS WHICH HAVE A RELATIONSHIP TO WORK FORCE IMPACT CONSIDERATIONS. THUS, FOR EXAMPLE, IF A TECHNOLOGICAL IMPROVEMENT/ CHANGE WAS PROPOSED WHICH APPEARED TO HAVE MAJOR NEGATIVE WORK FORCE IMPACTS, IT WOULD NOT BE ACCEPTED OR REJECTED WITHOUT CAREFUL CONSIDERATION OF ITS CONTRIBUTION TO SAFETY, CAPACITY, OR OTHER SUCH BENEFIT. RATHER, SOME SORT OF TRADE-OFF BETWEEN THE TWO DIVERGING IMPACTS WOULD BE SOUGHT IN AN EFFORT TO MAXIMIZE THE POSITIVE CONTRIBUTION WHILE MINIMIZING AND FULLY UNDERSTANDING THE NEGATIVE FEATURES.

THE SELECTION OF ETABS AS THE TRIAL VEHICLE FOR A FIELD IMPACT ASSESSMENT WAS BASED ON SEVERAL FACTORS. FIRST, WHILE THE PROGRAM HAD BEEN ENTERED INTO THE FORMAL DEPARTMENTAL SYSTEMS ACQUISITION MANAGEMENT PROCESS, KEY DECISION POINTS WERE STILL SEVERAL YEARS IN THE FUTURE. THUS, REAL IMPACT ON THE PROGRAM SHOULD BE POSSIBLE. SECONDLY, WHILE THE TECHNOLOGY WAS NEW, THE BASIC FUNCTION WOULD REMAIN THE SAME, MUCH AS A CRT TERMINAL WORD PROCESSOR REPLACES PAPER AND A TYPEWRITER. THIRDLY, THE EXTENT OF THE CHANGE WAS ORGANIZATIONALLY CONFINED, CLEARLY IDENTIFIABLE, AND WOULD NOT BE APPARENT TO USERS OF THE NATIONAL AIRSPACE SYSTEM OUTSIDE THE FAA. FINALLY, THERE WAS AVAILABLE A REASONABLE QUANTITY AND FIRMNESS OF DOCUMENTATION ON THE ETABS SYSTEM; THERE WAS NO APPARENT PRE-EXISTING ORGANIZATIONAL OR WORK FORCE HOSTILITY TO THE CHANGE; AND THE PROGRAM MANAGER WAS RECEPTIVE TO THE NOTION OF INVOLVING THE FIELD WORK FORCE AND ORGANIZATION IN HIS DEVELOPMENT PROGRAM.

THE STRUCTURE, ORGANIZATION, AND OPERATION OF THE FIELD IMPACT EVALUATION PROCESS MADE USE OF A DIAGONAL SLICE GROUP SELECTION AND OPERATION CONCEPT.

A. DEFINITION OF DIAGONAL SLICE. DIAGONAL SLICE GROUPS ARE COMPOSED OF MEMBERS SELECTED BECAUSE OF THEIR DIFFERENT ORGANIZATIONAL PERSPECTIVES. A TYPICAL DIAGONAL SLICE GROUP WOULD INCLUDE OPERATING PERSONNEL, FIRST-LEVEL SUPERVISORS, MIDDLE MANAGERS, AND HIGH-LEVEL MANAGERS. THIS TYPE OF GROUP DIFFERS FROM A HORIZONTAL SLICE (PEER GROUP) IN THAT SEVERAL DIFFERENT ORGANIZATIONAL LEVELS ARE REPRESENTED. IT DIFFERS FROM A VERTICAL SLICE GROUP IN THAT NO MEMBER HAS DIRECT CONTROL OR SUPERVISORY RESPONSIBILITY OVER ANY OTHER MEMBER. IN OTHER WORDS, NOBODY'S BOSS IS IN THE GROUP. FIGURE 1 ILLUSTRATES, IN OVER-SIMPLIFIED FORM, THE DIFFERENCES AMONG THESE THREE GROUPS.

B. PURPOSE. TO BE EFFECTIVE, A DECISION, PROBLEM SOLUTION, OR RECOMMENDATION MUST BE HIGH BOTH IN QUALITY AND IN ACCEPTANCE.

IN TERMS OF SOLUTION, QUALITY DIAGONAL SLICE GROUPS HAVE THE ADVANTAGE OF POSSESSING MULTIPLE ORGANIZATIONAL PERSPECTIVES FROM WHICH TO VIEW THE PROBLEM. NOT ONLY ARE DIFFERENT FUNCTIONS REPRESENTED BUT DIFFERENT ORGANIZATIONAL LEVELS ARE ALSO INCLUDED. SOLUTIONS GENERATED FROM SUCH HETEROGENEOUS GROUPS WOULD HAVE MET THE TEST OF A MULTITUDE OF ORGANIZATIONAL PERSPECTIVES AND, THEREFORE, SHOULD BE OF HIGHER QUALITY. IN ADDITION, THE SPECIFIC TYPES

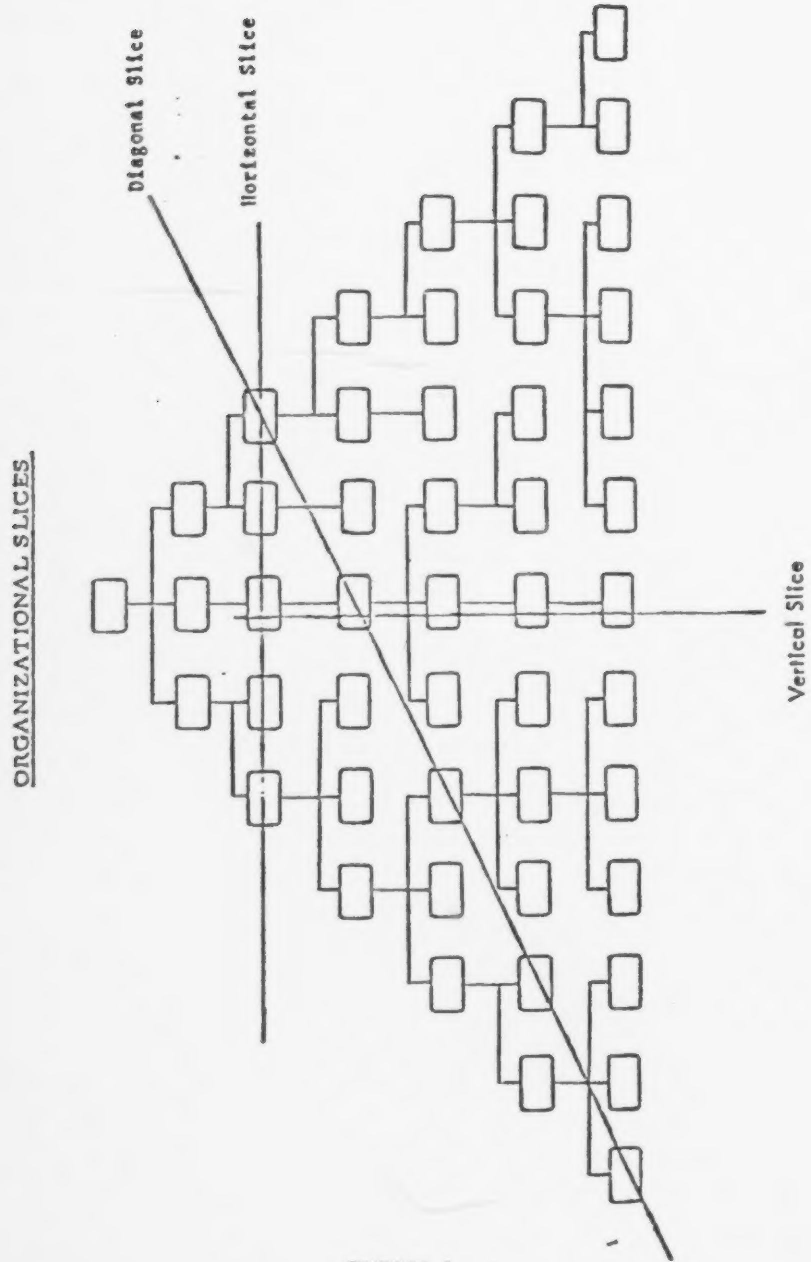
ORGANIZATIONAL SLICES
Diagonal Slice
Horizontal Slice
Vertical Slice

FIGURE 1

OF ORGANIZATIONAL PERSPECTIVES INCORPORATED IN DIAGONAL SLICE GROUPS ARE IMPORTANT IN INCREASING THEIR POTENTIAL FOR HIGHER QUALITY SOLUTIONS.

ACCEPTANCE ADVANTAGES OF PRODUCTS FROM DIAGONAL SLICE GROUPS REST CHIEFLY ON THE FACT THAT THOSE TO BE AFFECTED BY THE SOLUTIONS WERE REPRESENTED IN THE FORMULATION OF THOSE SOLUTIONS. A DIAGONAL SLICE GROUP REPRESENTS A MICROCOSM OF THE ORGANIZATION. A SOLUTION ACCEPTABLE TO THIS MICROCOSM SHOULD HAVE A GREATER CHANCE OF ACCEPTANCE BY THE ORGANIZATION THAN SOLUTIONS FROM OTHER TYPES OF GROUPS (SEE FIGURE 2).

C. MAKE-UP AND SIZE OF THE GROUP. THE MEMBERS OF THE DIAGONAL SLICE GROUP SHOULD REPRESENT A CROSS SECTION FROM ALL LEVELS WITHIN THE FAA WHO WILL MAINTAIN, OPERATE, AND MANAGE THE NEW OR MODIFIED SYSTEM. CONSIDERATION SHOULD ALSO BE GIVEN TO INCLUDING MEMBER(S) FROM USER ORGANIZATIONS. IN SHORT, MEMBERSHIP OF THE GROUP SHOULD BE DISPERSED FUNCTIONALLY AND ORGANIZATIONALLY TO TAKE ADVANTAGE OF NUMEROUS ORGANIZATIONAL PERSPECTIVES IN ASSESSING THE NEW SYSTEM. DIAGONAL SLICE GROUPS ARE GENERALLY LARGER THAN OTHER PROBLEM-SOLVING GROUPS. THEY RANGE IN SIZE FROM 4 TO 15 MEMBERS. THE LARGER SIZE IS NECESSARY TO PROVIDE FOR REPRESENTATION FROM MOST ORGANIZATIONAL LEVELS. THE PROBLEMS ASSOCIATED WITH LARGE WORKING GROUPS EMPHASIZE THE NEED FOR SELF-MANAGEMENT AND FACILITATION FUNCTIONS. LARGER GROUPS CAN OPERATE PRODUCTIVELY IF EFFECTIVE USE

EMPHASIS AT DIFFERENT ORGANIZATIONAL LEVELS

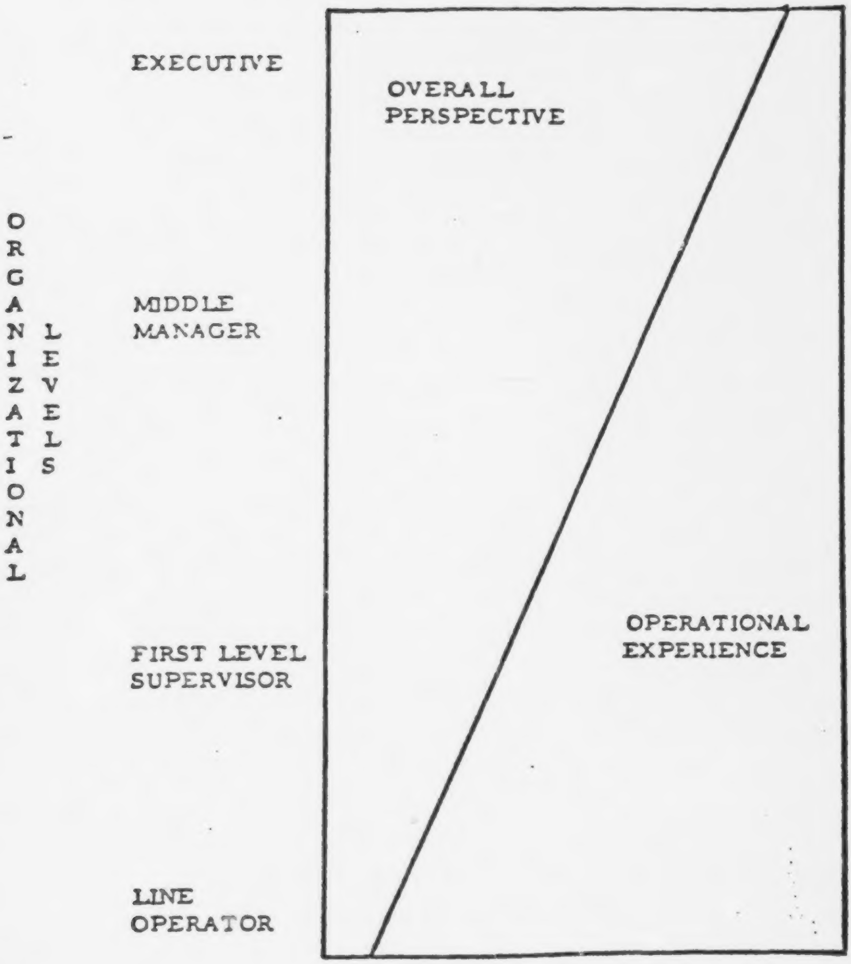

FIGURE 2

IS MADE OF INDIVIDUAL AND ALTERNATING SUBGROUPS. THE GROUP CAN MEET AS A WHOLE TO REVIEW AND DISCUSS SUBGROUP OR INDIVIDUAL PRODUCTS AND TO DEAL WITH GROUPWIDE ISSUES. IN THIS WAY, CONCENTRATED EFFORT CAN OCCUR, WITH THE EVENTUAL END PRODUCT STILL HAVING TO PASS THE TEST OF MULTIPERSPECTIVES BEFORE IT BECOMES THE GROUP'S ACCEPTED SOLUTION.

D. SELECTION OF THE DIAGONAL SLICE GROUP. A PREMISE UNDERLYING THE DIAGONAL SLICE APPROACH IS THAT THERE ARE INTELLIGENT, CREATIVE INDIVIDUALS AT ALL LEVELS IN THE ORGANIZATION. THEY HAVE NOT GRAVITATED TOWARDS ANY ONE LEVEL DUE TO PERSONAL DESIRES, AGE, INDIVIDUAL CIRCUMSTANCES, AND DIFFERENCES IN EDUCATIONAL AND ORGANIZATIONAL OPPORTUNITIES.

IN PULLING TOGETHER A DIAGONAL SLICE GROUP, THERE ARE GENERALLY AMPLE PEOPLE RESOURCES TO CREATE AN EFFECTIVE GROUP.

BESIDES INTELLIGENCE AND CREATIVITY, THOSE SELECTED SHOULD BE HIGH IN THE INTERPERSONAL SKILLS NECESSARY FOR EFFECTIVE GROUP FUNCTIONING. IN A DIAGONAL SLICE GROUP THERE IS LIKELY TO BE A HIGH DEGREE OF AMBIGUITY AND HIGH CONFLICT POTENTIAL. MEMBERS SHOULD BE SELECTED WHO CAN OPERATE IN SUCH AN ENVIRONMENT.

NOMINATIONS FOR GROUP MEMBERSHIP SHOULD BE SOLICITED FROM AS WIDE A SPECTRUM OF THE AGENCY AS POSSIBLE. THOSE SUPERVISORS AND MANAGERS FROM WHOM THE NOMINATIONS ARE SOLICITED SHOULD BE MADE

AWARE OF THE GROUP'S MISSION AS WELL AS THE INDIVIDUAL SKILLS AND EXPERIENCE DESIRED. A MAJOR EMPHASIS NEEDS TO BE PLACED UPON THE CRITICAL PROCESS OF SELECTING GROUP MEMBERS. THE NEED FOR DIFFERENT PERSPECTIVES IS CRUCIAL TO A SUCCESSFUL ASSESSMENT.

E. TRAINING AND BRIEFINGS. IN ORDER FOR A DIAGONAL SLICE GROUP TO FUNCTION EFFECTIVELY IN FULFILLING ITS MISSION, SOME TRAINING SHOULD BE PROVIDED. THIS TRAINING NEED NOT BE LONG AND INVOLVED. HOWEVER, IT SHOULD ADDRESS:

1. THE PURPOSE FOR WHICH THE GROUP WAS FORMED.
2. RATIONALE FOR USING DIAGONAL SLICE GROUPS.
3. DETAILED BRIEFINGS CONCERNING BACKGROUND DATA AND ISSUES WITH WHICH THE GROUP MUST DEAL.

F. OPERATING CHARACTERISTICS OF DIAGONAL SLICE GROUPS. DIAGONAL SLICE GROUPS CAN BE OPERATED IN A VARIETY OF WAYS FOR A MULTITUDE OF PURPOSES. THE FOLLOWING CHARACTERISTICS ARE ILLUSTRATIVE OF EFFECTIVE DIAGONAL SLICE GROUPS.

1. EQUALITY. WHILE MEMBERS DIFFER GREATLY IN ORGANIZATIONAL STATUS OUTSIDE OF THE GROUP, IT IS ESSENTIAL THAT THERE BE A SENSE OF EQUALITY WITHIN THE GROUP. SINCE EACH MEMBER REPRESENTS AN IMPORTANT ORGANIZATIONAL PERSPECTIVE, EQUALITY WITHIN THE GROUP ENHANCES THE PROBABILITY THAT EACH PERSPECTIVE

HAS AN EQUAL OPPORTUNITY TO INFLUENCE THE DEVELOPMENT OF THE SOLUTION. THIS CHARACTERISTIC MEANS THAT THE HIGHEST STATUS MEMBER DOES NOT AUTOMATICALLY BECOME THE CHAIRPERSON. WHICHEVER MEMBERS SHOW THE GREATEST CHAIRPERSON SKILLS, REGARDLESS OF STATUS OUTSIDE THE GROUP, COULD BE ASSIGNED THE ROLE, OR IT MAY BE ROTATED AMONG THE MEMBERS. THE EQUALITY CHARACTERISTIC DOES NOT MEAN EVERYONE DOES EVERYTHING EQUALLY: IT JUST MEANS THAT ROLES ARE NOT BASED SOLELY ON A MEMBER"S ORGANIZATIONAL STATUS. THIS CHARACTERISTIC ALLOWS THE DEVELOPMENT OF ROLES BASED UPON PERCEIVED COMPETENCE, CONTRIBUTION, AND DESIRE.

2. CONSENSUS. TO REALIZE THE POTENTIAL OF DIAGONAL SLICE GROUPS FOR MAXIMIZING SOLUTION QUALITY, EACH ORGANIZATIONAL PERSPECTIVE SHOULD BE CONSIDERED IN THE SOLUTION. A MAJORITY VOTE MODE OF OPERATION LEAVES OUT THE MINORITY MEMBERS' PERSPECTIVES IN THE DEVELOPMENT OF A SOLUTION. THIS NEGATES THE VERY PURPOSE OF PUTTING TOGETHER A DIAGONAL SLICE OF THE ORGANIZATION. CONSENSUS IS A MORE DIFFICULT MODE OF OPERATION BUT WITHOUT IT VARIOUS ORGANIZATIONAL PERSPECTIVES ARE NOT REPRESENTED. THIS LOWERS THE PRODUCT'S POTENTIAL QUALITY AND LOWERS THE POTENTIAL ACCEPTANCE BY ORGANIZATIONAL LEVELS WHOSE PERSPECTIVES WERE LEFT OUT IN DETERMINING THE SOLUTION. CONSENSUS DOES NOT MEAN UNANIMITY. RATHER, IT MEANS THAT EACH MEMBER FEELS HIS OR HER POSITION HAS BEEN ADEQUATELY HEARD. IN ADDITION, THE MEMBER IS WILLING TO LIVE WITH THE COURSE OF ACTION PROPOSED EVEN THOUGH HE OR SHE BELIEVES ANOTHER COURSE OF ACTION MIGHT BE MORE

BENEFICIAL. OPERATING BY CONSENSUS, WHILE REQUIRING MORE WORK ON THE GROUP'S PART, MAXIMIZES THE POTENTIAL FOR THE EMERGENCE OF AN EFFECTIVE SOLUTION.

3. FACILITATOR'S ROLE. DIAGONAL SLICE GROUPS USUALLY INCLUDE AT LEAST ONE PERSON PROFESSIONALLY SKILLED IN GROUP DYNAMICS. THIS PERSON SENSES DEVELOPING GROUP PROBLEMS AND FACILITATES THE GROUP IN CONSTRUCTIVELY ADDRESSING AND WORKING THROUGH THESE GROUP PROCESS ISSUES. THE FACILITATOR DOES NOT NORMALLY INVOLVE HIMSELF IN THE CONTENT OF THE GROUP'S TASK, BUT RATHER OBSERVES AND COMMENTS ON THE PROCESS THE GROUP USES TO ACCOMPLISH ITS TASK. ATTENTION TO PROCESS IS A RESPONSIBILITY OF ALL GROUP MEMBERS; THE FACILITATOR'S ROLE IS TO ENSURE THAT THIS RESPONSIBILITY IS CARRIED OUT.

4. USE OF OUTSIDE RESOURCES. UNLESS A DIAGONAL SLICE GROUP IS ADDRESSING A RELATIVELY SIMPLE PROBLEM, THE QUALITY AND ACCEPTANCE OF ITS PRODUCT MAY BE ENHANCED BY THE SELECTED USE OF OUTSIDE RESOURCES SUCH AS PROFESSIONAL CONSULTANTS. ALTHOUGH VAST DIFFERENCES IN VIEWPOINTS AND PERSPECTIVES WITHIN THE GROUP SHOULD PROMOTE OBJECTIVITY, A POSSIBLE WEAKNESS IN USING A DIAGONAL SLICE GROUP IS THAT ITS SOLUTION MAY BE REGARDED BY SOME AS PAROCHIAL, A PRODUCT OF AMATEUR AND UNSOPHISTICATED THINKING. TO COUNTERACT THIS POTENTIAL WEAKNESS, DIAGONAL SLICE GROUPS SOMETIMES EMPLOY PROFESSIONAL ASSISTANCE. WHEN THE GROUP

IS ADDRESSING COMPLEX PROBLEMS WITH NUMEROUS INTERACTING DIMENSIONS, PROFESSIONAL ASSISTANCE MAY BE BENEFICIAL IN DEFINING THE LIMITS AND BOUNDS OF THE VARIOUS PROBLEM DIMENSIONS. IF CONSULTANTS ARE USED IN THIS WAY, THEIR ROLE SHOULD BE SPECIFICALLY DEFINED AND LIMITED TO PROBLEM ISSUES RATHER THAN ALTERNATIVE SOLUTIONS.

G. INTEGRATING AND APPLYING RESULTS. DUE TO THE WIDE SPECTRUM OF MEMBERSHIP IN THE GROUP, APPLICATION OR INSTITUTIONALIZATION OF RESULTS AND RECOMMENDATIONS CAN PRESENT PROBLEMS. SINCE NORMAL PATHS INTO AN ONGOING ORGANIZATIONAL PROCESS HAVE BEEN BY-PASSED, UNUSUAL CARE, THOUGHT, PLANNING, AND ACTION ARE REQUIRED TO INCORPORATE GROUP PRODUCTS INTO NORMAL WORKING PROCEDURES AND RELATIONSHIPS.

THIS DOES NOT PRECLUDE THE MODIFICATION OF EXISTING STRUCTURE OR PROCESSES; HOWEVER, IT MUST BE CLEAR WHAT IS BEING INTEGRATED, WHERE, AND BY WHOM. TOWARDS THIS END, THE USE OF IN-HOUSE CONSULTANTS OR RESOURCE PEOPLE SEEMS TO OFFER A BRIDGING MECHANISM FOR THE INTEGRATION OR APPLICATION OF GROUP RESULTS. IT IS VERY IMPORTANT THAT THE ROLE OF THESE BRIDGERS BE CLEARLY AND DISTINCTLY IDENTIFIED SO THAT UNWANTED MODIFICATIONS OR DILUTIONS OF THE ORIGINAL GROUP'S PRODUCT DOES NOT OCCUR.

THE PROCESS OF THE ETABS FIELD IMPACT EVALUATION CONSISTED OF FOUR MAJOR ELEMENTS; IMPACT ASSESSMENT, IMPACT QUANTIFICATION, ALTERNATIVE DEVELOPMENT, AND RECOMMENDATIONS/CONCLUSIONS. SEVERAL ADDITIONAL SUPPORTING ACTIVITIES WERE INCLUDED SUCH AS INITIAL TEAM BUILDING EXERCISES, TECHNICAL EDUCATION OF THE TEAM (REGARDING THE ETABS SYSTEM) AND TEAM MAINTENANCE FUNCTIONS. A MODEL OF THE PROJECT IS SHOWN IN FIGURE 3. THE 6-8 WEEK INTERVAL BETWEEN TEAM MEETINGS SHOULD BE NOTED. THIS INTERVAL PROVIDED AN OPPORTUNITY FOR EACH TEAM MEMBER TO INTERACT WITH HIS COLLEAGUES AT HIS HOME FACILITY IN A REAL WORLD SETTING TO FORM AND CONFIRM IMPRESSIONS AND PERCEPTIONS OF IMPACT. THIS INTERACTION OR HOMEWORK PROVIDED BOTH AN INCREASED BASE AND CREDIBILITY FOR IMPACT ASSESSMENTS AND A BROADENED SPECTRUM OF PERCEIVED PARTICIPATION ON THE PART OF FIELD ORGANIZATIONS AND WORKERS. ONE DIFFICULTY IN CONDUCTING A FIELD IMPACT ASSESSMENT OF A MAJOR PROGRAM WHILE IN THE DESIGN AND DEVELOPMENT STAGE IS THE NORMALLY LONG PERIOD OF TIME BETWEEN THE SUBMISSION OF AN IMPACT REPORT AND THE FIELD IMPLEMENTATION PHASE OF THE PROGRAM. THE FIELD PEOPLE MAKING THE INPUT HAVE A VALID CONCERN AS TO WHETHER THEIR SUGGESTIONS AND RECOMMENDATIONS FOR CHANGE HAVE BEEN HEEDED OR FILED WITHOUT ACTION. INTERESTINGLY ENOUGH THE ETABS IMPACT EVALUATION TEAM INCLUDED THE RECOMMENDATION FOR A FOLLOW ON TRACKING AND REPORTING MECHANISM IN THEIR FINAL REPORT. WE PLAN TO RECONVENE THE TEAM AT THE FAA TECHNICAL CENTER IN ATLANTIC CITY, N. J., SOMETIME EARLY NEXT YEAR AFTER THE DELIVERY OF THE ETABS ENGINEERING MODEL. THIS WILL PROVIDE A FIRST REVIEW OF BOTH THE

ETABS
Field Impact Evaluation
Team Meetings — Time/Activity Distribution

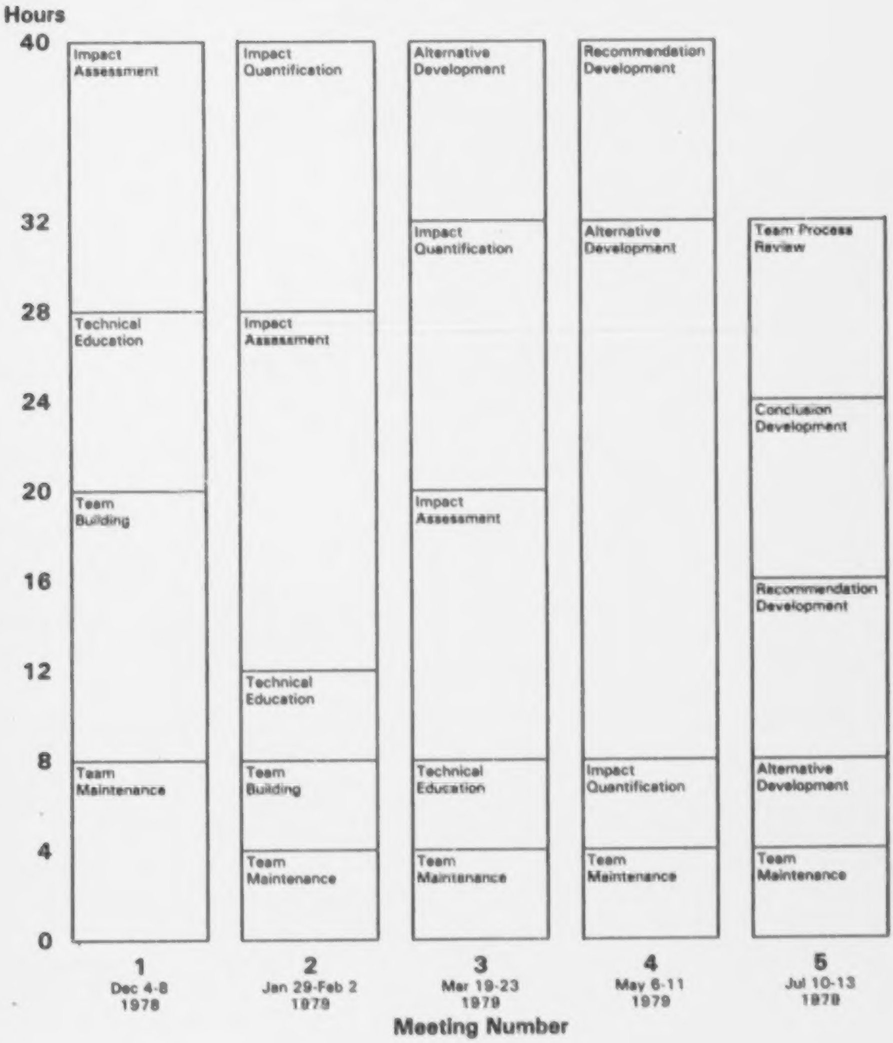

FIGURE 3

VALIDITY OF THE IMPACT ASSESSMENT AND SOLUTION RECOMMENDATION REPORT AND AN APPRAISAL OF THE DEGREE TO WHICH THE RECOMMENDATIONS HAVE BEEN INCORPORATED AND THE RESULTING NEGATIVE IMPACT RELIEF (OR AGGRAVATION).

RESULTS OF THE DEMONSTRATION PROJECT APPEAR IN SEVERAL GENERAL AREAS. THE FIRST IS IN THE DESIGN AND DEVELOPMENT OF THE ETABS ENGINEERING MODEL. THE SECOND IS IN THE AREA OF FIELD PARTICIPATION AND ACCEPTANCE OF SYSTEM CHANGE. IN A LETTER TO THE DEPUTY ADMINISTRATOR, DATED OCTOBER 24, 1979, DISCUSSING THE FIELD IMPACT EVALUATION PROCESS. THE DIRECTOR OF THE GREAT LAKES REGION SAID,

> "THE FIELD IMPACT EVALUATION METHOD IS AN EXCELLENT VEHICLE FOR PINPOINTING POTENTIAL PROBLEMS PRIOR TO IMPLEMENTATION OF A MAJOR SYSTEM CHANGE.
>
> FIELD INPUT IS AN ABSOLUTE NECESSITY ON ANY MAJOR CHANGE OR RESEARCH AND DEVELOPMENT PROJECT. THE RECOMMENDATIONS OF THE PEOPLE WHO WILL USE A NEW SYSTEM MUST BE CONSIDERED DURING ITS DEVELOPMENT. THE BENEFITS ARE SIMPLY THAT THERE IS MUCH LESS CHANCE OF SOMETHING BEING OVERLOOKED AND THE FIELD GAINS A VALUABLE RESOURCE. THE DIAGONAL SLICE CONCEPT ASSURES THAT THE FIELD INPUT FROM ALL THOSE AFFECTED WILL BE RECEIVED AND CONSIDERED. TECHNOLOGY ASSESSMENT PROVIDES AN IDEAL STRUCTURE FOR GATHERING AND PRESENTING THEIR RECOMMENDATIONS."

THE THIRD IS RECOGNITION BY THE ENGINEERING AND DEVELOPMENT ORGANIZATION OF THE VALUE OF THE PROCESS IN PRODUCING A BETTER PRODUCT. IN A LETTER DATED NOVEMBER 20, 1979, TO THE DIRECTOR OF THE GREAT LAKES REGION, THE DIRECTOR OF THE SYSTEMS RESEARCH AND DEVELOPMENT SERVICE SAID,

> "IT WAS ENCOURAGING TO RECEIVE YOUR VERY POSITIVE ENDORSEMENT OF THE FIELD IMPACT EVALUATION PROCESS AS APPLIED TO THE ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS). THE ETABS PROGRAM MANAGER SHARES YOUR VIEW OF THE BENEFITS OF THE PROCESS AND WILL FOLLOW THE RECOMMENDATIONS OF THE EVALUATION REPORT TO THE MAXIMUM EXTENT ALLOWABLE WITHIN THE TERMS OF THE DEVELOPMENT CONTRACT.
>
> THE ETABS FIELD IMPACT EVALUATION REPORT HAS BEEN BRIEFED TO A LARGE NUMBER OF TOP LEVEL FAA MANAGERS INVOLVED WITH DEVELOPMENT AND IMPLEMENTATION OF FUTURE SYSTEMS. THEY NOW RECOGNIZE THE FIELD IMPACT EVALUATION METHOD AS AN IMPORTANT NEW TOOL WHICH CAN BE APPLIED DURING THE DEVELOPMENT PROCESS TO AVOID FUTURE PROBLEMS. TIMING OF THE IMPACT EVALUATION WITHIN THE LIFE CYCLE OF A PROGRAM, AS WELL AS THE APPROPRIATE SELECTION OF THE FIELD PERSONNEL, APPEARS TO BE THE KEY TO SUCCESS."

SUBSEQUENT TO THE COMPLETION OF THE PROJECT AN INTRODUCTORY SEMINAR ON FIELD IMPACT EVALUATION WAS PREPARED AND PRESENTED TO PROGRAM MANAGERS. IT FOCUSED ON THE KEY ROLE A PROGRAM MANAGER

PLAYS IN DECIDING IF A FIELD IMPACT EVALUATION OF HIS PROGRAM IS DESIRABLE AND COST BENEFICIAL AND IF SO, RESOLVING THE CRUCIAL ISSUE OF WHEN TO DO IT. REGARDING THE QUESTION OF SHOULD IT BE DONE, THE ANSWER IS YES, IF:

- THE PROJECT HAS TROUBLE GETTING A CLEAR AND CONSISTENT STATEMENT OF OPERATIONAL REQUIREMENTS
- THE PROJECT NEEDS EARLY APPRAISAL OF DESIGN APPROACH
- IMPLEMENTATION WILL HAVE BROAD EFFECTS ON FIELD OPERATIONS/PROCEDURES/MAINTENANCE/TRAINING
- PROGRAM WILL NEED FIELD INVOLVEMENT IN LATER STAGES OF PROGRAM
- OTHER MAJOR FAA ELEMENTS NEED TO BE AWARE OF PROGRAM DIMENSIONS--TO HELP THEIR ADVANCED PLANNING

AS FOR THE TIMING, THE ANSWER IS, DO IT WHEN:

- THE CONCEPT IS DEVELOPED FAR ENOUGH THAT IT CAN BE DEMONSTRATED, NOT JUST TALKED ABOUT
- THE DESIGN IS NOT SO FIRM THAT IT CANNOT BE CHANGED WITHOUT MAJOR COST/SCHEDULE IMPACT

TYPICALLY--THIS IS BETWEEN EXPLORATORY DEVELOPMENT AND ENGINEERING MODEL DEVELOPMENT

ADDITIONALLY, THE PROGRAM MANAGER IS AN ESSENTIAL RESOURCE TO THE FIELD IMPACT EVALUATION TEAM. HE MUST SUPPORT THE TEAM'S PROCEEDINGS. HE CAN EXPECT TO INVEST SIGNIFICANT TIME AND EFFORT IN THE ACTIVITY.

HIS ROLE IN PROVIDING THIS SUPPORT IS NOT TO DEFEND OR SELL A PARTICULAR PROGRAM. RATHER IT IS TO:

- EXPLAIN THE PROGRAM (BACKGROUND, REQUIREMENTS, EXPECTED BENEFITS, RISKS, STATUS)
- PROVIDE STAFF EXPERTISE THROUGHOUT
- ARRANGE FOR VISITS/DEMONSTRATIONS
- CRITIQUE CONCLUSIONS/FINAL REPORT

HE FURTHER:

- MUST BE AS RESPONSIVE AS POSSIBLE

- CAN EXPECT

  - REINFORCEMENT/SUPPORT
  - CHALLENGES
  - QUESTIONS
  - SUGGESTIONS FOR CHANGE

- SHOULD PROVIDE FEEDBACK TO FIELD IMPACT EVALUATION AS PROGRAM PROGRESSES

THE SEMINAR PRESENTED THE FOLLOWING CONCLUSIONS:

FOR SELECTED PROJECTS, FIELD IMPACT EVALUATION IS A UNIQUE AND IMPORTANT TOOL

IT IS COSTLY AND TIME CONSUMING

ITS RECOMMENDATIONS/OBSERVATIONS MUST BE TAKEN SERIOUSLY

TURNING TO THE SUBJECT OF NEEDED RESEARCH AND FUTURE WORK, I BELIEVE FUTURE RESEARCHERS NEED TO FOCUS ON ACHIEVING A BETTER UNDERSTANDING AND QUANTIFICATION OF THE CONNECTION BETWEEN SYSTEM PERFORMANCE/PRODUCTIVITY AND HUMAN ATTITUDES AND BEHAVIORS. THE ABILITY TO IDENTIFY SPECIFIC RESULTS SHOULD ENHANCE OPPORTUNITIES FOR THE APPLICATION OF SOCIO-TECHNICAL DESIGN AND IMPLEMENTATION PROJECTS.

ADDITIONAL WORK IS ALSO REQUIRED IN THE AREA OF ORGANIZATIONAL PLACEMENT AND INTEGRATION OF SOCIO-TECHNICAL PROJECTS. CREDIBILITY, PARTICIPATION, AND ACCEPTANCE IS GREATLY AFFECTED BY WHERE AND HOW IN THE ORGANIZATION THE FUNCTION IS PLACED AND CONDUCTED.

FINALLY, WE NEED A BROADER AND TIGHTER COUPLING BETWEEN THEORY AND CONCEPT DEVELOPMENT ACTIVITIES, AND FIELD IMPLEMENTATION AND APPLICATION ACTIVITIES. THESE HEARINGS PROVIDE A VERY POSITIVE STEP IN SUPPORT OF SUCH AN IMPROVEMENT. SUPPORT AND ASSISTANCE IN THE AREA OF DOCUMENTATION, DISSEMINATION AND DISCUSSION OF PROJECT ACTIVITIES WILL ASSIST IN DEVELOPING ANSWERS TO THE QUESTION OF HOW TO DESIGN AND MANAGE NEW TECHNOLOGY SO AS TO INCREASE PRODUCTIVITY AND DEVELOP HUMAN RESOURCES.

MR. CHAIRMAN, THAT CONCLUDES MY PREPARED STATEMENT. AT THIS TIME, I WOULD BE PLEASED TO RESPOND TO QUESTIONS YOU OR OTHER MEMBERS OF THE SUBCOMMITTEE MAY HAVE.

Mr. LUNDINE. There are several unions representing employees of Federal Aviation Administration, is that correct?

Mr. KOCH. Yes, sir.

Mr. LUNDINE. I believe there are about three or four.

Mr. KOCH. Yes.

Mr. LUNDINE. Were any of the unions involved in any way in your project—either to the extent of selection of employees in that diagonal slice group or consulted or involved in any other way?

Mr. KOCH. No. We went to the regions and asked for nominations of all the categories of people.

Mr. LUNDINE. Who nominated them?

Mr. KOCH. The regional management or the facility manager or whatever.

Mr. LUNDINE. So this is really a management project, even though it involved operation-level people it was a management project and no way joint labor represented and management? Is that right?

Mr. KOCH. Right. The unions had no involvement with the project.

Mr. LUNDINE. Was the idea ever put forth, to the best of your knowledge—to have union involvement?

Mr. KOCH. I wasn't personally involved. I think there were some discussions at one time, but I wasn't directly involved.

Mr. LUNDINE. Earlier this year I wrote a letter to the Administrator—is that your boss?

Mr. KOCH. He's the boss, yes.

Mr. LUNDINE. The Administrator of the Federal Aviation Agency, and he replied on this point. I'd like to make those letters a part of the record at this point, if they are available.

Are you using—that is, is the FAA—using this technique, the diagonal slice assessment group in assessing the impact of any other technological changes?

Mr. KOCH. Sort of. I have been planning to do a similar assessment of something we call integrated flow management system. We had planned to initiate that this fall. We had gone actually to the point of asking for nominations. However, the design—technical design—of the system hasn't solidified to the point where it makes sense to subject it to an evaluation so that's a long answer to say yes, we've got something picked out; it's on hold right now. I'm hoping that we can get it going fairly soon.

Mr. LUNDINE. As far as you know that, this technique has the support of management?

Mr. KOCH. Yes.

Mr. LUNDINE. In the evolution from a manually controlled air traffic system to an automated system, has this increased or decreased the level of on-the-job stress experienced by air traffic controllers?

Mr. KOCH. Gee, I really—I don't know as I quite could say. I guess we've got a problem of—how do you measure stress and what is it and that sort of thing.

Mr. LUNDINE. I was going to ask that next. Are there any, to the best of your knowledge, are there any studies of stress in this area? I know we've certainly all heard and read a lot about it in the last few months. Are there any studies that you know of?

Mr. KOCH. I think there are a number of studies—all of which sort of—my impression is they don't match. There is no one agreed-upon set of numbers that you could go measure. Somebody wants to measure blood pressure, somebody wants to do something else, and it's sort of a hodge-podge of——

Mr. LUNDINE. Have you ever been a controller yourself?

Mr. KOCH. No, I'm an engineer. No, I've never been a controller.

Mr. LUNDINE. And you've never directly supervised them?

Mr. KOCH. Not in doing air traffic control. When I ran the division I had a bunch of controllers working for me, but no I never supervised the control situation.

Mr. LUNDINE. So you wouldn't say that apart from empirical studies that you have any personal observation or experience of that?

Mr. KOCH. No. No. I come at it from the engineering side.

Mr. LUNDINE. Do you think that the rapid introduction of technology into the air traffic control system has had an impact on the safety of that system?

Mr. KOCH. Oh I think it's improved it.

Mr. LUNDINE. So if safety is the ultimate purpose would you say that technology has improved the productivity, if we were to use that in the broadest sense of the word—the purpose of the system—but that our attempt to gage the impact of the introduction of that technology on the people working there is in its infancy?

Mr. KOCH. Yes, that's one of my concerns—that I would hope somehow down the road we could make a better coupling between those two. But still the question comes up, and we heard it last week, of the managers that look at the bottom line and they expect numbers. If you invest *x* dollars they want to see the outcome, and when people propose projects such as these it's very hard to say here is the dollar outcome. You invest this and you will get that back for it.

Mr. **Lundine**. In your opinion what can we do to enhance the idea that we should take greater care to assess the impact of the new technology on the people using it?

Mr. **Koch**. It's this question of short-term/long-term.

Mr. **Lundine**. You mean, in your opinion there's been too much concentration by policymakers at all levels on the short term?

Mr. **Koch**. That's my impression—from——

Mr. **Lundine**. What do you mean by short term?

Mr. **Koch**. Well, 2 years, or short term in terms of budget cycles, in management like—being over in engineering and kind of been in long-range plans I tend to think in terms of 10, 15, 20 years—of a payoff or of an evolution.

Mr. **Lundine**. And you're saying that from the best of your observation management and policymakers have not paid as much attention to the longer term evolution of technology?

Mr. **Koch**. Well, that's really not quite right because we're certainly worried about improving our computer base 10 years from now where there are requirements.

I guess I am thinking in terms of what are the long-term people payoff benefits. We don't have a way of getting at those or they don't seem to be talked about.

Mr. **Lundine**. Earlier in your testimony you mentioned Professor Walton from the Harvard Business School. Was he a consultant to you in carrying out this ETAB project?

Mr. **Koch**. No. No. I had a Ph. D. student from Yale Organization School and Management work with me on this, as sort of the professional group dynamics behavioral guide. I was the technical bridge into the organization.

Mr. **Lundine**. Is there any outside consultant working in this area with the FAA right now?

Mr. **Koch**. Not that I am aware of.

Mr. **Lundine**. I have no further questions.

If there are no further questions, today's hearings will be adjourned.

I thank you, Mr. Koch, very much for your testimony. I hope you appreciate that there are all sorts of other questions about the FAA that not only this Member but others wanted to ask and appreciate our——

Mr. **Koch**. I certainly do.

[Whereupon, at 12:20 p.m., the subcommittee was adjourned.]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

WEDNESDAY, SEPTEMBER 16, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to notice, in room 2325, Rayburn House Office Building, commencing at 9:15 a.m., Hon. Stan Lundine presiding.

Mr. Lundine. The Subcommittee on Science, Research and Technology will come to order.

This is the fifth day in a series of 6 days of hearings that have been generously authorized by the chairman, Congressman Doug Walgren, from Pennsylvania to my right, whom I thank very much for this commitment of time to the subject of human factors in innovation and productivity.

For your information, the ringing of bells and commotion is because both the Democratic Caucus and Republican conferences are meeting this morning, and I understand that Congresswoman Heckler is attending the Republican Conference and may be able to join us as the ranking minority member. She has, like Chairman Walgren, expressed great interest in this subject.

This morning I am particularly delighted to be focusing on innovations in office technology. We have heard from witnesses about the steel industry, the shipping industry, and I guess the closest we have come to office technology so far is the telephone system. It seems to me that the amount of concentration in the human resource area of improving performance and improving the quality of working life and improving productivity must, in a society that is becoming more service-oriented, focus as well on the office workplace as it does on the factory floor.

The first witness we have this morning is James Driscoll, professor of the Sloan School of Management, at the Massachusetts Institute of Technology. Mr. Driscoll has written and consulted widely in this area, and I am delighted to welcome you to the committee.

We have a prepared statement entitled "The Need for Social Control of Office Automation," which will be made a part of the record. Your entire statement will be made a part of the record.

You may proceed any way you see fit, Mr. Driscoll.

STATEMENT OF JAMES W. DRISCOLL, ASSISTANT PROFESSOR, SLOAN SCHOOL OF MANAGEMENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Mr. DRISCOLL. Thank you, Congressman Lundine, and Congressman Walgren. I would like to thank you and your staffs that put this hearing together. I was glad to have the opportunity to talk with Congressman Lundine earlier, because I have had great respect for a long time for his work in this area, beginning when he was the mayor up at Jamestown.

As an aside, I couldn't help but be struck in coming into this room for hearings on the human factor in technology. If you exclude the people we have shot up to the Moon, the only place where I see the people who are responsible is sort of over here in the upper right-hand corner, and everything else is sort of machines and hardware. It is kind of a symptom of the problem that I think we're trying to address, because none of this hardware and certainly none of those people would have gotten up to the Moon if it hadn't been for a lot of people down here on the ground working, who were productive and innovative in a way that we are all familiar with.

During the past week, I am sure you have had a lot of testimony which documents something that I believe in very strongly, and that is that the primary contribution to productivity and innovation in American society is the human factor, and it is a requirement for social innovation to create that productivity.

The principles that I tend to think of that are associated with that are participation, identity, and equity. And if you have people who have the ability to make some contribution to the decisions that affect them at work, who have some reason to identify with the organization for which they work, and who feel like they are rewarded equitably for working, then that is the source of productivity and innovation.

That is exemplified in a number of experiments or projects, for example, that were undertaken up at Jamestown. I have done my own studies and a lot of work on a particular innovation called the Scanlon plan for union-management innovation, and I would take it as wisdom, that it is a known fact that it is possible to increase productivity and innovation by social arrangements and that that's the dominant factor.

I am happy to be here because that is not happening in the office. We have in the United States a rush to the office of the future, office automation, integrated office technology, call it what you will, and those principles for increasing productivity and innovation, those social principles, I don't see being followed at all.

My experience in office automation began, I guess, in about 1973 as a graduate student up at Cornell, when we began studies that were then called word processing. I came to MIT in 1975, after completing my doctorate at Cornell, and since then have run courses and seminars on office automation and have done research on attempts to automate officeworkers in the United States, and have traveled to some extent to Western Europe to keep abreast of developments there.

When I say office automation—since I guess this is the first that you have really dealt with that issue, as you said—I am thinking of things that are generally referred to as word processing, sort of generating texts, letters, by computer-base support; electronic mail, using computer messages as a substitute generally for telephone vocal conversation; decision support systems tailoring a computer system to support a manager or professional; tele-conferencing, which would be the use of video-vocal electronic median. For example, to make this testimony unnecessary, I could have set up in Cambridge before a television camera and spoken into a microphone and, at least according to the advocates—of course, then I wouldn't have had breakfast and gotten to meet all the people on the staff and talked directly. But the advocates of the technology neglect those social benefits.

Anyhow, that's what office automation is. Essentially, it is the application of computers to general office work. Data processing has been specific in the past—accounts receivable, payroll, high-volume routine applications. But now what we are talking about is using the computer to support the things that everybody does—type letters, have meetings, have telephone conversations. That is what office automation is.

I see the following facts about automating office work. The first is that there is no doubt we are doing it. There is a tremendous rush on to automate general office work. I was in a meeting last week where I learned about an insurance company that plans to spend $100 million over the next 3 to 5 years to automate their office work. That is one company. It is that order of magnitude that is being talked about and done all over the economy. So there is no question that we are putting this computer support out in the workplace.

However, the second fact is that there is little evidence that that saves anybody any money, that there is any productivity increase from that investment. At the meeting I was at the comment was that they made that $100 million investment on faith, that you had to believe it was going to have an impact. The big growth industry among consultants these days is to come up with creative ways to justify large investments in office technology.

We did a review of nine large users of office automation and we could find not a single attempt by managers to go back after the fact to see whether there had been any productivity gain from that investment in new technology in the office. There is a justification that the vendors always provide at the beginning as to how it is going to get rid of people and save labor dollars, and there is going to be a net benefit. But after the fact there is no research being done internally to find out what the benefits are. So you have this rush to automate and we have little evidence of economic benefit, and we have little attempt really to evaluate the effort. At the same time, particularly if you go outside the United States, there is tremendous fear that we are going to incure major social costs from automating office work.

I must, I think, put in a precaution here, that what I am saying is to some extent speculative. We don't have hard research on all of these. There is some evidence that exists—and clearly the greatest need and one which these hearings address—for research to examine the social costs of automating office work.

Nonetheless, there seems to be social costs in three areas. The first is health and safety. There is no question that working in front of most of the office automation equipment that is currently on the market for a long period of time is bad for you. It is at least bad for your eyes and your body in terms of physical strain, and there is some evidence that working at machine-paced, computer-mediated work in general is a source of exacerbated psychological stress.

Second, there is substantial indication that for a large chunk of the workers in the office, office automation means less skilled jobs, less skilled work, more specialized work. It is not true across the board because these systems tend to be developed with a manager or professional in mind, so that for a few people in each office place, office automation means greatly enhanced support and services. But when you look at it across the board, there is a substantial number of people who apparently are going to be doing more routine, less skilled work.

The third social cost is in the area of unemployment. In Europe, I can't think of a country I was in that didn't have a Government commission report or a labor union report predicting 30 percent unemployment, industry by industry, as a result of office automation. I personally—that's not my research, and I think that may well be overstated. The managers in the same society said there would be no unemployment as a result of automation.

My own view is that there will be a threat of increased unemployment. I think we have already begun to see it. As you increase the percentage of low-skilled work at the bottom of office hierarchies, there are then a greater number of people who don't have any incentive to stay on the job a long period of time. I think you get, at a minimum, an increase in frictional unemployment and all the social costs that are associated with unemployment as a consequence.

Why is it that we have no evidence of productivity despite all of this massive investment in office technology? I think it is because the technology, as it is implemented, ignores those three principles that I outlined and the kind of innovative approaches that you have heard testimony on, I am sure, from people, looking at your lineup of speakers over the last few days.

The technology is being implemented in what I would call a systems analytic or traditional data processing approach, where the purpose of the technology seems to be to control people, to control officeworkers. The assumption is, if you don't keep a close watch—you begin with line counters and word-processing equipment so you know how many lines the typist has turned out every minute, and now you keep track of every telephone call that somebody makes on a computer, so you make sure nobody is calling their family or their bookie or whatever, any non-work-related call they would make. So the equipment is being designed and implemented to control people that you think are going to be lazy.

It is being designed and implemented so that the people who use it don't need a lot of skill, so that you can reach into a wider labor market, and the consequence is highly specialized jobs, and the emphasis is on providing information to a few key decisionmakers in an organization, the assumption being that those few people are what makes an organization productive.

Well, those principles are just the opposite of the ones I began with, so you have the technology being designed and implemented in a way that contradicts everything that we know about how to make people productive and innovative in offices.

It is possible to do it a different way. If you just take word processing, for example, if in the process of introducing word processing to an organization you begin with the person you're trying to support and say "what in that office manager's job doesn't have to be done by him"—deciding that a report has to be done every week, gathering information, creating parts of the report, and you redesign the work that is being done by the boss and the secretary such that the secretary has an opportunity to do more of the kinds of higher skill, higher responsibility jobs that are customarily excluded from secretarial and clerical work. Then you can introduce word processing equipment in a decentralized, dedicated way, so that you can enhance the quality of worklife, the productivity of that secretary, by bringing in the technology.

But if you just come in and kind of throw a piece of equipment in there, we have found no evidence that that is going to increase productivity by itself. So it is possible to bring in this new technology in a way that does take into account those social principles that I indicated earlier, and there are some examples around the world of how to do it.

I think that in the office, in order to get a push toward this social innovation, it is not going to be possible to rely simply on voluntary efforts of managers. I have been watching those for a long period of time, and the current technological path seems to be a consequence of that sort of voluntary effort. I think somehow we have to develop a social pressure for social innovation, and one obvious way that the Congress can move in that direction is by funding and sponsoring research which looks at; One, social innovations and documents, but two, also documents the social costs. We need research in the United States. We don't have it. We need research from a worker kind of perspective so that the funding is channeled through labor institutions, either unions or officeworker interest groups. NSF has played a major role in that area in the past, summarizing some of the research that has been done in manufacturing sectors, for example.

The second area I would see—and this is not directly in the purview of this committee—is that we need to do something to address the balance of power in the office workplace. In offices you have workers who are not represented by unions, who are overwhelmingly female, who are in what are called secondary labor market jobs—low pay, low skill, no promotional opportunities, little reason to stay on the job—and therefore there is no kind of institutional voice pushing for social considerations in the office. In the absence of it, I sit day after day in meetings with managers where the focus is on hard technology and the neglect of social considerations.

Some things that might be considered in that area to begin with is research, again documenting some of these ergonomic costs, so that the Government steps into the workplace and says you can't sell equipment which hurts people. There is such equipment being sold on the market today.

Another would be to try and do something about the strong antiunionism of office managers. I have met very few managers in my travels in office automation who are not petrified at the thought that their workers might be represented by a labor union. They are willing to take risks to insure that that doesn't happen, and in the current regulatory environment it is possible for them to do that.

If it is concluded that it is not possible to beef up traditional collective bargaining, which is Congress' way of addressing that balance of power historically, then I think that the Congress ought to give consideration to something like the forms of worker representation that we do have in Scandinavia where, for example, there might be an elected worker representative in office workplaces of substantial size where any decision about new technology would have to at least be communicated to that person and that person would have some training at company expense to be able to provide the kind of systematic input about social costs that I have described.

In summary, the voluntary efforts of managers in the United States seem to have gotten us into a technological path which doesn't increase productivity or innovation, which seems to provide enhanced services to a very few people in the economy, and yet we are spending an awful lot of money on it. I am delighted to have this opportunity to come down and see whether we can't do something at the regulatory, at the governmental level, to try and correct what I have called elsewhere a technological boondoggle.

Thank you.

[The prepared statement of Mr. Driscoll follows:]

THE NEED FOR SOCIAL CONTROL OF OFFICE AUTOMATION

(By James W. Driscoll, assistant professor, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Mass.)

The technological path of office automation in the U. S. (and around the world) shows little economic benefit and threatens substantial social cost. An alternative, more humanistic path, could lead to both economic and social benefits. Current organizational practices and government policy make such benefits unlikely. The principles underlying a humanistic technology are well known and apply as well to office as to factory work. The Subcommittee has invited testimony from intellectual and practical proponents of the humanization of technology. However, my concern is that their testimony will focus too much on exceptional experiments and on the single organization or employer. My own study of office automation suggests de-humanization as the technological norm and the existence of cumulative impacts emerging only at the societal level, even if many firms adapted more humanistic approaches. Therefore, I will confine myself to brief remarks on how to humanize office automation and raise these macro concerns.

A word of caution and congratulations is in order first, however. My testimony on office automation is suggestive and speculative. We have very little research on the impact of office automation in the U.S. and almost none conducted from the perspective of office workers. My testimony reflects that limited research and my own small contribution as a researcher and consultant to both management and labor groups. There is an urgent need for systematic, large-scale research on office automation, especially from the workers' perspective. Management groups in the U.S. have the resources to undertake research on their own, but to date such research has focussed narrowly on the development of computer hardware and software. Social and economic assessments are rare. The federal government must redress this balance by funding research which reflects both these neglected disciplinary perspectives and the interests of office workers.

How to Improve Productivity and Innovation

Human energy is the key to both productivity and innovation. Economists can ascribe only a modest portion of productivity improvement to investment in new capital equipment. Indeed, one intensive longitudinal study showed that the bulk of productivity improvement was due, not to major acquisitions of new technology, but to a continuous process of suggestions and modifications made by people--workers, managers, and engineers.

The preponderance of evidence suggests that people produce more and innovate more in organizations structured to allow workers to participate in decisions, to identify with organizational objectives, and to share equitably in the rewards of productivity and innovation. For example, the long-recognized but much-ignored fact that workers become more productive after a union is elected in my opinion reflects, at least in part, the improved levels of participation, equity, and identity possible with collective bargaining. My own research on union-management cooperation under the Scanlon Plan has corroborated the potential for gains in productivity and innovation from enlightened human resource management. The General Accounting Office has recently documented the economic benefits of Scanlon and other gain-sharing plans.

The Case of Office Automation

Experiments to improve productivity in offices reveal a similar pattern of success: (1) where office workers participate in the design, selection, and implementation of new office technology, productivity is more likely to improve; (2) where pay and other organizational rewards are redistributed equitably to reflect technological change and productivity gains; and (3) where human resource management practices (such as increased promotional opportunities, enriched job designs, training in participative supervision) encourage identification of workers with organizational objectives. Unfortunately such cases are rare even in Western Europe where much of the relevant research has been conducted.

By contrast with this pattern for productivity, the usual automation of office work follows a traditional path of technological development and implementation which I have labelled "systems analytic". Such applications reflect what Douglas McGregor long ago called "Theory X" assumptions about human nature. The purpose of such systems is to simplify office tasks, control office workers, and provide information to managers and higher-level professionals. From the line counts of early centralized word processing centers to the lists of outside numbers called on automatic call distributors, office automation has emphasized specialization and control.

The Absence of Economic Payoff from office Automation

Not surprisingly, given the discrepancy between office automation and the practices to increase productivity and innovation, there is precious little evidence of any economic benefit accruing to employers. Indeed, in my own systematic review of nine large users of office automation, we could locate not one single attempt to go back after the installation of new equipment in order to find out whether the increase in worker output had justified the cost of new equipment. Given the absence of cost savings, most management consultants and vendors today emphasize the "value added" or "soft dollar" savings of office automation. While such intangible benefits are appealing to those managers and professionals whose power and status in the organization are enhanced by office automation, such benefits must be weighted against the costs of the current technological path.

The Social Costs of Office Automation

The potential harmful effects from the "systems analytic" path of office automation are many. To begin, at the level of individual workers, reduced quality of work life and the associated decreased motivation to produce and innovate were mentioned above. In addition there are serious health hazards posed by office automation. Besides, the psychological stress of machine-paced, computer-mediated work, there is no question that visual display units physically strain the eyes, neck, and back. While adequate rest breaks and proper equipment design can eliminate most terminal-related health problems, American employers and equipment manufacturers have made negligently slow progress in their areas by comparison to their European counterparts.

Moving to the aggregate level, unemployment constitutes a real threat from office automation. While direct displacements due to office automation are uncertain (and probably depend more on inefficient substitutions of capital for labor), any increase in the proportion of secondary labor market jobs promises increased unemployment of the frictional variety. If more office workers receiving low pay perceive less chance for promotion, and develop fewer skills on the job, they will turnover more often. There would be no incentive for strong attachment to their employers. Such unemployment brings with it increased levels of crime and mental illness.

More disturbing to me than the potential unemployment problem is the misallocation of scarce societal resources. The emerging target market for office automation vendors is "managers and professionals". However, we have no clear scientific understanding of the nature of the work performed by these groups or of their needs for computerized support. Indeed, a strong argument can be made that enhancing the dependence of organizations on a few individuals decreases both productivity and innovation. So here we have a vast expenditure of money targetted on a small and privileged set of occupational categories with no expectation of economic benefit to the employer or the society.

The concentration of investment may be even more striking by industry. According to my experience, two industries are the foci of office automation--banking and insurance. By what political process has the U.S. decided to place such a high priority on those two social objectives? Clearly we are not simply automating information intensive industries. No comparable investment in computerization has benefitted libraries or education. We are allowing large private sector institutions to make questionable investments in the storage and manipulation of financial information for the benefit of that small sector of the society that uses substantial insurance or banking services.

Federal Policy Consideration

While it may be beyond the purview of this Subcommittee, I would be remiss not to mention the need for federal government action to increase social control over the private boondoggle that is current office automation.

1. Worker Participation in Technological Decision Making. Before any substantial investment in office automation is made, individual employers should be required to consult with an internally-elected worker representative (by union procedures where applicable) on the design, selection, and implementation of new technology. Each representative would be trained at employer expense and have the right to request a neutral, expert opinion if the proposed installation failed to balance social costs adequately against economic benefits. The Scandinavian countries provide several models for such forms of participation.

2. Safety and Health Standards. The Occupational Safety and Health Administration ought to develop ergonomic standards for visual display terminals and consider more general protections against psychological stressors in automated office work.

In the absence of federal regulation, office automation poses a substantial threat to the working conditions of millions of largely female, nonunionized office workers. Unionization given current labor law is a slow, uncertain process. The employers of office workers are uniformly and adamantly opposed to unionization and appear willing to risk what they euphemistically call "exposure" to unfair labor practices to discourage unionization. Regulation appears to be a necessary step.

Needed Research

While the need for research on office automation is great, the mechanisms for controlling the research process are more important than the specific substantive issues. In particular, a large portion of research funds should be targeted to institutions representing office workers. Labor unions, womens' organizations, and community groups such as the many local Coalitions for Occupational Safety and Health (COSHs) are likely candidates. For example, a group tentatively titled Group for Office Automation Technology (G.O.A.T.), representing each of these three institutions, has been meeting in Boston for several months and provides a paradigm institution for undertaking or at least overseeing research.

Appropriate research methods also deserve careful attention. Research should be:

1. Macro-level. It would be possible in 1990 to have hundreds of primary labor market employers provide humane working conditions to their employees and still incur substantial social costs. How is that possible? Secondary labor market jobs are being created today in service bureaus and in home work. The aggregate social costs suffered by such "outside" workers will be missed if attention is focused on a few experimental employers or locations. Some samples of populations should be undertaken, such as all the employers or workers in a community or industry.

2. Longitudinal. Given the high turnover of office workers, research should attempt to follow at least some workers as they move from employer to employer.

3. Interdisciplinary. The social costs span economics, psychology, and medical epidemiology. Assessing any application of office automation requires a broad approach.

The substantive topics for research seem clear:

1. Assessing the social costs of office automation.

2. Demonstrating and evaluating the impact of experiments on a humanistic technological path.

3. Identifying and assessing alternative federal policy approaches. How can collective bargaining among office workers be encouraged? How viable are elected worker representatives as a voice in technological choice without the support of a union? How can the government influence investments in new technology without sacrificing whatever advantages are inherent in the market mechanism?

4. Describing the process of technological choice. The current "systems analytic" path for office automation results from the aggregation of countless individual and organizational decisions about user needs, technological feasibility, and objectives. If government policy is to have effect, we need a much better understanding of the process by which well-intentioned people combine to set what appears to be an economically and socially questionable direction for office automation.

Mr. **Lundine**. Thank you very much.

You first gave three key principles of social innovation—participation, identity and equity.

Mr. **Driscoll**. Yes.

Mr. **Lundine**. I understand participation and equity. Can you describe what you mean by identity?

Mr. **Driscoll**. I guess I should give credit where credit is due. I think I stole these ideas from Carl Frost and some colleagues who wrote a book on one of the social innovations that I have studied. I think it's a nice was of summarizing a whole lot of research.

By identity, I mean do my objectives as a worker overlap with the objectives of the organization. For example, think of a traditional female officeworker in the United States today. She doesn't get paid very much money—I mean, I think of my secretary. I was going to pick on you and your staff, but I'll pick on me and my secretaries up at MIT. We don't pay them very much money. We don't give them any training. There is no such thing, or not much such thing as a promotion to senior secretary. You certainly don't get promoted to asssistant professor. That's for us white male Ph. D. types. So there is little reason for my secretary to feel that she has any sense of accomplishment, that she has anything to do with the work that I'm doing at the Sloan School.

For example, when I talked about how you might introduce word processing so that you get a sense of identity, if the secretary at least knew more about what the boss really was doing, had more information about—you know, you can't be identified with it if you don't know what it is. If she had an opportunity for promotion to, say, the purchasing department, if she had the opportunity for promotion to purchasing agent so that her career track led her to identify with the organization. In other words, the identity means an overlap of goals and you have got to come up with some organizational mechanism so that people see the organization's goals as things they ought to buy into.

Mr. **Lundine**. You said that in your experience there seldom was evaluation of whether office automation actually improved productivity after its introduction.

Why do you think that is? Certainly American business is interested in measuring their own effectiveness.

Mr. **Driscoll**. I think it is—You have to not think of it as American business. You have to stop and think who would do the evaluation. You have to think of the organization as what it is, which is a political system. I mean where there are different interest groups by department.

For example, if the data processing organization decides to spend $100 million on office automation, the person who makes that decision is not terribly interested in evaluating the results. Because what if it's wrong?

Mr. **Lundine**. Yes, but what if it's right? Then it makes him look very good.

Mr. **Driscoll**. That's right. I guess it makes him risk-averse or something.

I mean, there isn't an interest group that is obviously served by finding out that it didn't work. That person who makes the decision, his or her rewards are increased budget, staff——

Mr. LUNDINE. Promotion, really.

Mr. DRISCOLL. Sure.

Mr. LUNDINE. All right. Let's take the insurance company as an example. It would seem to me that that insurance is a fairly competitive business. There are a lot of insurance companies. Competitively, one of the things that that company that is making the $100 million investment would want to achieve is better performance than its competitors.

It would seem to me that it would be in the interest of the manager who essentially made the decision to acquire that equipment to evaluate if. If anybody is going to discover that it hasn't lived up to its expectations, it would seem to me to be in his interest to be the one to do that, rather than to allow somebody else to come along and do that and second guess his decision.

Mr. DRISCOLL. But the assumption, I think, that underlies that sort of view is of a rational world and a rational organization. Herb Simon at Carnegie Mellon got a Nobel Prize for pointing out to the rest of the economics community that that isn't the way it works. The economists didn't think—well, I won't go into that.

The fact of the matter is that the notion of a tight feedback from the market to internal organizational decisions is greatly overestimated. When you go in and talk to managers who are making decisions, those are criteria—market performance, cost—which are used to justify decisions. And they are a factor. I don't want to say they are nonexistent altogether. But there are so many other objectives that that individual or that particular department has that, you know, competition in the marketplace is only one of a number of different influences. I guess I am arguing that, given the fact that I don't find evaluation studies being done, I have to assume that these other political, personal factors outweigh the kind of market pressure that I, you, or any classical economist would assume drives organizational decisionmaking.

Mr. LUNDINE. Turning to the area of the social costs of office automation, what do we know about the level of stress associated with the increased levels of automating the office and who should do the research that you believe needs to be done to understand the social costs?

Mr. DRISCOLL. We don't know much about the level of stress. I don't want to make statements that aren't sort of documented by the record. There are a number of researches, some of them undertaken by groups like working women, and others by more academic types, that indicate that automation is an additional source of stress, that working on an automated piece of equipment is an additional source of stress, particularly for people who are already stressed with respect to not receiving high levels of pay and having close supervision. It has kind of a multiplier effect. So that if you think—we were talking earlier about a newspaper editor who has got a pretty good job to begin with, providing him or her with a piece of computerized support, I don't think, and the evidence to date wouldn't indicate that they're going to be more stressed by it. Where it comes I think is in the interaction between preexisting sources of stress found in the workplace—low pay, low promotional opportunity, tight supervision. And then you add on to that the kind of physical and psychologic pressure that comes from the computer.

Mr. **Lundine**. Turning to the other——

Mr. **Driscoll**. Excuse me. I didn't answer the second part of your question, who should do the research. The Government has got to provide some money to people who are worried about stress qua stress, who aren't worried about it just as a barrier to productivity, a barrier to innovation.

There is very little research being done in companies on the social impacts of automation. You can't find it. So what I think the Government has got to do is step in, whether it is through NSF or some other mechanism, and provide research to academics who are concerned about social costs, and more importantly, either to organizations like labor unions, women's movement organizations, office worker organizations, to do the research, or at least to provide policy guidance on what problems and what methods are going to be undertaken. Because to rely on, as to what you aptly said earlier, to rely on private companies to do this research is going to mean 5 years from now you're going to call me down here for testimony and I'm going to be able to say we have a lot of research on bits and bytes and hardware and we still don't have any better understanding of the social costs of office automation than we did when I first testified.

Mr. **Lundine**. I am interested in your second social cost that you identified, because I think that compared to the greater amount of work in this whole area of increased worker participation in the manufacturing sector it would tend to contradict what you find in the office sector. Maybe you would disagree with that even as a beginning. But you say that it results in less skilled work.

Yet almost all the evidence is that, particularly where workers are given any participation in the introduction of new technology, robotics or factory automation, it has resulted in more skilled work. In other words, the worker is relieved of the most physically strenuous, boring, and tedious aspects of their job. That is at least what I have heard often expressed in terms of automating the factory.

Now, let's take this to the office. You used to have a secretary that typed at least in a draft, as I remember, with carbon copies, eight and nine carbons, getting carbon ink all over her hands and everything else. When a mistake was made, you had to deal with each of those carbon copies. And now you introduce a different, simple word-processing technique and you don't have that. It seems to me you have, as you later testified, elevated the secretary to somebody who really needs higher skills, who can get rid of the more boring aspects of the job by employing technology. You have, in fact, reduced the number of less-skilled workers and probably increased the skill levels of the people that you would have in a more automated office.

Where am I wrong in my analysis?

Mr. **Driscoll**. The place where you're right is that new technology, both in manufacturing and in the office, does eliminate some dirty, boring work, OK. Some. I think you need to get testimony and talk to some other people about—your statement that the impact of motiviation is to increase the level of skill in the workplace. That is a subject of debate. There are two perspectives on that.

An alternative view is that you take the middle, if you will, out of the occupational distribution, so that you move some people up to the top—and there is an increase in skills there—and you have other people whose skill levels are reduced. The example I think of is in some banks I have studied, where in processing a loan in the past you had sort of a loan processor who handled the transaction all the way through until ultimately turning it over to a loan officer for final decision. Now with the advent of computerized support, what you have is a number of people who are providing data entry into small pieces of that loan application process, so that a couple of people, the loan officer and perhaps a few people close to that now do have more information at their disposal, but a whole bunch of people who used to be in the middle of that process are now reduced to providing sort of data entry. For them, the net has been a decrease in skill levels. I mean, there really is an area of debate. I wouldn't take that across the board as true.

With respect to the example of the secretary in the office, what I described was a way in which you could use new technology. The way in which the new technology came into the office had nothing to do with that. What you did was—the vendors were saying, the way to improve productivity in the office is to take all of your secretaries and put them in one room in the basement—they didn't use to say down in the basement; that's just where we always put them, the Sloan School included. I don't know how it is down here at the Rayburn building——

Mr. LUNDINE. We have exempted ourselves from OSHA requirements, so we can do anything we want. [Laughter.]

And if you want to walk around and see the worst work environment in America, just wander into any staff office of any Congressman or Senator.

Mr. DRISCOLL. I'm glad you said that so I didn't have to say it. [Laughter.]

But the net was that you had a bunch of people sitting in a centralized word-processing environment, typing stuff that they had no idea where it came from or where it was going. Sure, they weren't getting carbon on their hands, but you had a bunch of people who were not doing any of the higher skilled pieces of work which secretaries traditionally have done.

Now, that has been alleviated somewhat by the decentralization of some of this word processing technology. But I would still assert that in banking, insurance secretarial work, some of the places that I have studied, you do get a reduction in skill. You have a number of people who are confined to data entry positions who don't have opportunities for promotion.

Granted, it eliminates some dirty work, particularly in manufacturing, but I am saying we have to have better research that looks very carefully, before and after, what the work is that people are doing. I see evidence that for a number of these people there is less skill than there was before.

Mr. LUNDINE. Let's turn to the brighter side of things, if we could, for just a minute.

Are you familiar with the example of cases in which office workers have been involved with the installation of automated equipment and where it has worked out relatively well?

Mr. **Driscoll**. Yes. There are a number of cases in—I would say more in Scandinavia than here. When I was in Sweden and Norway, they have made some progress of extending their general principles to the office.

In the United States there are particular individuals—Larry Williams and Tom Lodall, some people I work with up at Cornell, James Taylor out at UCLA and others—who have demonstrated I would say the generalizability of the quality of worklife approach, the participative approach, to introducing new office technology.

Mr. **Lundine**. But could you give us a concrete example of a company or a division where those principles have been followed and where the——

Mr. **Driscoll**. Sure. When I go in and do these things they are research, so I can't give you the specifics. But in an international marketing office, there was a task force formed of people from several levels in the organization to discuss the work that was going to be automated and to have some say in the design of the work prior to the decision to pick particular vendors. The evidence that I see reported—this was again done up at Cornell—indicates that they have been able to document both a savings in actual cost and, more importantly, they have kept track of the kind of communication that came out of that department before and after, and they found an increase—this is Larry Williams and Tom Lodall—found an increase in the proportion of that communication which was future oriented rather than past oriented. The people in that office were doing more self-initiated work rather than reacting to requests for information. So here is an example of where they were able to sort of document a qualitative change, but one which, at least given the mission of that organization, was generally accepted as an improvement.

In Scandinavia there is an emphasis, as you know, on legislated involvement. And given that sort of background environment, there have been I would say more examples in the insurance and banking industries, where they have formed a kind of task force for work redesign, for the design of the sociotechnical system before the computerized technology comes in. I think following that kind of pattern, as we have found again and again in manufacturing environments, it is possible and there is evidence that suggests it is possible to improve productivity.

Mr. **Lundine**. Well, that leads me to the final point, which was also your final point, of what the Government might do in this regard other than sponsoring research. I must say that I have a very strong bias against following the Scandinavian tendency toward legislating. I question whether you can legislate this, particularly in the American context, even if you wanted to, even if you had no philosophical concerns, just from a strict, pragmatic standpoint.

You said maybe the Government has to step in and do something with respect to worker representation. Now, exactly what do you mean by that? Worker representation on boards of directors or what? Conceivably, how would we legislate? I believe in the sociotechnical analysis and worker participation, but I don't understand what your recommendation is with respect to what the Government could legislate.

Mr. **Driscoll**. OK. First, when I said representation, I was not thinking of representation on the boards of directors. I was thinking of the possibility of a worker representative for call it technology or quality of worklife, who would have to be consulted before major change in—a major investment, for example, in the technology or change in working conditions were undertaken, at least to provide some advice and consultation.

I struggle with the same dilemma. I don't know how to do it. It is clear that you can't legislate change in society. The legislation in some sense follows cultural drift. Therefore, I think that research to publicize social cost, something to try and change the value system that I see widespread in management in the United States is important. But what concerns me is, when you look at—I had reason to look over our social legislation in the United States for publication recently. When you look at occupational safety and health, and you look at equal employment opportunity, what we have done in the United States is backed away from the principle of collective representation. With the Wagner Act, we essentially said, "Look, people are sitting down in factories; they won't let us make cars; we've got to do something. So we are going to go with collective bargaining. We are going to allow elected representatives to be a spokesperson for the workers."

When you look at legislation since then, what we have done is we have said the individual worker has got to go to the Government. If you have got a complaint about occupational safety and health and you don't have a union, call up the Department of Labor. If you are a woman and feel like you have been discriminated against and you don't have a union, call up the Government.

What I am concerned about is this excessive emphasis on individual worker responsibility may have undermined sort of the principle of collective representation that I think is necessary to get change in the workplace. What I am proposing is that when Congress thinks of any piece of legislation, that it gives some consideration of ways in which you can give participation to workers, not as individuals who have to go to their Government, but as groups of people who can get together and discuss the problems that they face. I would see this as low level worker representation.

I would rather have it be by collective bargaining. That would be my preference. But there is a real question on whether that will happen. I am saying we ought to explore other ways of encouraging this collective discussion, this collective involvement in decision-making, and one way would be for the Government to establish a representative who would have to be elected and who would speak for a group of people.

Mr. **Lundine**. As with our earlier testimony in these hearings, your remarks are provocative and interesting enough so that I would almost like to switch roles with you and react to that. But I will resist that temptation and ask Mr. Rheem if he has a question.

Mr. **Rheem**. Thank you, Mr. Chairman.

We have been hearing a lot about the worker participation and the need for worker participation for the effective utilization of technical innovations. The message from the unions was that perhaps this isn't an appropriate area for the Federal Government to be involved.

Do you think the unions are capable or have the technical expertise themselves to assist workers in making valuable decisions?

Mr. Driscoll. I think that they have some expertise which would be of great value—having known people who I have worked with professionally who now work with labor unions, I can't knock their competence. I think the Federal Government, for example, could look at the New Directions program in the Occupational Safety and Health Administration. If you look at the specialists in the labor movement who really know a lot about occupational health problems, you will find almost to a person that they were either trained or are currently supported with New Directions money. So I think there is a real contribution that the Government could make to provide funding, to provide that expertise. It is clear to me that they don't have enough now.

Mr. Rheem. Should workers have veto power over technical innovations?

Mr. Driscoll. Workers have veto power now where there is a collective bargaining contract in effect. It is a limited veto. I find that reasonable.

I think if you provide people with the opportunity for advance consultation, and you provide them with training and information, so that you don't just bring somebody in to sit in on a department decision that really doesn't understand the technology, then I think you can accomplish a great deal without a veto. So I am not advocating that they—It would be more important to me that they be involved early and that they be systematically given education and training, than to have veto power.

Mr. Rheem. Your comments on the fact that there are no studies to date which show that a lot of these technical innovations produce significant increases in productivity would lead one to think that the industry itself would be doing a lot of research in this area. You say they are not.

I am wondering, is there anything going on, for example, in the Massachusetts area—for example, there is a Massachusetts High Technology Council. Is this on the agenda of any industry group?

Mr. Driscoll. Not that I know of.

I don't know why they don't. I mean, I have a speculation it is all cynical and critical. I give this presentation and I support the activities which I undertake on behalf of my social conscious hat, I guess, by going out to managers for an exhorbitant fee and telling them what a lousy job they are doing in the office of the future. They always come up to me and say, "Well, we have done the studies." I say, "Great. I don't have to make this generalization any more. Send them to me." I sit in my office in Cambridge and I wait, and I wait, and I wait, and they don't come. Maybe they are done in a proprietary—what you see is a tremendous emphasis on showing how we could save money if you did it. In other words, it is a marketing effort, but no after-the-fact.

Mr. Rheem. Thank you, Mr. Chairman.

Mr. Lundine. We would now like to call on Judith Gregory, who is the research director for Working Women. We have your entire testimony and it will be made a part of the record. If you can summarize, we would appreciate it.

[A biographical sketch of Ms. Gregory follows:]

Working Women
NATIONAL ASSOCIATION OF OFFICE WORKERS

JUDITH GREGORY, RESEARCH DIRECTOR
WORKING WOMEN, NATIONAL ASSOCIATION OF OFFICE WORKERS

Judith Gregory joined the WORKING WOMEN staff as Research Director in 1979. Formerly a radio journalist for a National Public Radio station, she reported on issues which affect working women including the impact of technological change in the office workplace.

As WORKING WOMEN's Research Director, Ms. Gregory oversees research on many areas in addition to computerization of office work including: trends and implications of service industry expansion; office workers' occupational health and safety; issues of special concern to working women 40 years of age and over; and trends in women's labor force participation by industry, occupation, and income level.

Ms. Gregory speaks frequently on the topic of office automation, and is the author of "Race Against Time: Automation of the Office", released by WORKING WOMEN in April, 1980.

Born in metropolitan New York, Ms. Gregory resides in Cleveland, and is 29 years old.

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STATEMENT OF JUDITH GREGORY, RESEARCH DIRECTOR, WORKING WOMEN, NATIONAL ASSOCIATION OF OFFICE WORKERS

Ms. GREGORY. We frequently hear the virtues of the "Computer Age" extolled, that automation provides tremendous increases in productivity, that "the move to electronics finally gives managers a way to enforce discipline and standardization in the office," and "that business can finally monitor and measure the clerical function."

We are all led to believe that these features of new office technology are to serve the desirable goals of increased efficiency and increased productivity.

In fact, the way computer technology is being introduced in many offices today not only causes suffering among millions of officeworkers, but also does not necessarily serve the goal of furthering productivity.

Exactly those features which managers extol—enforced discipline and standardization, computerized work performance monitoring—are major problems which plague officeworkers, undermine potential gains in effectiveness, cause new inefficiencies, and take a great toll on people.

I want to take you first into the world of the automated office by telling you the two stories of two women clerical workers.

Rose reentered the work force after 20 years of absence raising her family. Her excellent typing skills quickly landed her a job as 1 of 12 cathode ray tube operators in a downtown Cleveland publishing company. She describes how the system there worked: "The computer at one end of the room keeps track of the key strokes you do. The more key strokes, the more money you might get. At the end of the day the figures for all of us are posted. You look at your speed; you look at everyone else's. You say to yourself, 'Tomorrow, I am going to do better.' They get you thinking just like they want you to. You're really pushing hard."

In another instance, Amanda, who works for a major industrial firm in Cincinnati, paused at her video display terminal momentarily one day just as her manager walked in. "What are you doing," he demanded. "I'm just thinking for a minute," she replied. "Well, get back to work," he snapped. "You're not paid to think. I am."

These experiences happen every day.

As the United States continues the historic transition to an "information economy," we believe clerical workers, who number nearly 20 million and account for almost 1 in 5 of all U.S. workers, will be more affected by widespread office automation than other sectors of the work force. Women hold 80 percent of these jobs.

In April 1980, Working Women issued a report which was the first in the United States to describe these problems of office automation from the viewpoint of women office workers. And rather than reiterate all the points in the report, I would like to enter the report into the record.

Mr. LUNDINE. It will be made a part of the record.

[The information follows:]

RACE AGAINST TIME:
AUTOMATION OF THE OFFICE

An Analysis of the Trends in Office Automation
and
the Impact on the Office Workforce

The American workforce is undergoing enormous changes as clerical work replaces manufacturing employment as the base of the economy. Now clerical work is being transformed by automation of the office.

What is the effect of automation on the job itself, on the American economy, and on the office workers? Office workers are in a race against time trying to answer these questions before irreparable harm is done.

Karen Nussbaum

Karen Nussbaum
Executive Director
WORKING WOMEN
April 23, 1980

WORKING WOMEN, National Association of Office Workers, is a membership organization with affiliates in twelve major cities across the country and members in 45 states, working to win rights and respect.

For additional copies of this report, send $7 (institutions), $4 (individuals), or $3 (Working Women members) to WORKING WOMEN, 1224 Huron Road, Cleveland, OH 44115. For first class mailing, add 70¢.

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I. INTRODUCTION

Office automation as it is being introduced today aims "to automate office procedures", as I.B.M. points out, not "merely to mechanize tasks." It refers to the use of computer technology to process and transmit information, combining word and data processing. Automation also involves linking together today's many modern devices into "integrated office systems". Because new technology is being developed to computerize the very flow of work in the office, its potential impact is qualitatively different from previous office equipment which "mechanized" or "automated" routine tasks.

The microprocessor, or "computer-on-a-chip" is the cornerstone of the automated office, the scientific innovation making the "office of the future" a possibility. The impact of microprocessors has been compared to virtually every major invention in history -- the printing press, the cotton gin, the telephone, the steam engine and atomic energy.

"It will change language and thought as writing did," concludes Simon Nora, author of a report to the French Ministry of Industry. 1/ Microelectronic automation "is likely to bring about an organizational revolution among white collar workers comparable in magnitude to that resulting from the introduction of the assembly-line in blue collar work", predicts computer specialist James Carlisle. 2/ Computer salesmen sometimes see themselves as religious crusaders: "You've got to do a lot of missionary work to show managers they'll really benefit from an integrated electronic office..." Or, as radical agents of the technology which "the labor-intensive office desperately needs": "Yes, we are revolutionaries," says a Xerox salesman. "What we are doing will no doubt leave a very lasting impression on America. We are going to turn the world of white-collar work upside-down, inside-out and make it do what it's supposed to do -- work." 3/

We often hear praise of the "artificial intelligence" of today's microcomputers. Enthusiastic users, such as Government Accounting Office associate director Walter Anderson, sometimes get carried away in elaborating what minicomputers will soon be like. "By 2038, computers will be alive," predicts Anderson in a survey of future trends in Data Management, a trade journal, "equipped with IQ's equivalent to the requirements of construction workers or bank tellers." 4 /

Small wonder that many are chilled by such enthusiasm. In West Germany, factory and office workers alike have coined a new name for the chips from two words in English. They now refer to microprocessors as "job-killers".

II. WHAT OFFICF AUTOMATION MEANS TODAY

While word-processing is the key development in the automation of the office, the "office of the future" refers to a combination of microelectronic, telecommunications, and computer technologies. This report includes management's intention to restructure today's office work, in ways which set the stage for further use of computers, as part of the current concept of office automation. Following are definitions of a number of terms which appear throughout the report:

Computerization: the application of computers to office tasks or procedures.

Mechanization: The use of machines to perform specific functions much faster than they can be done manually. What was called "automation" in the 1950's and 60's is sometimes called "mere" mechanization now, e.g., key punching and a great deal of data processing.

Rationalization: Decision-making is taken out of work so that each person is required to work faster, doing a standardized "fragment" of the larger task. Work becomes routine and repetitive. Also called "routinization", "scientific management" or "deskilling".

Word-Processing: Preparation, editing, storage and retrieval of text. Takes its place alongside data processing (of numbers). Can be done on "stand-alone" equipment or connected to a computer-based system.

Microprocessor: A complete computer smaller than a postage stamp usually on a chip of silicon, also called a "micro-computer" or "mini-computer". Microprocessors make it possible to use computers economically for very complex purposes, particularly advanced word-processing.

Video Display Terminal (VDT): The key unit of the automated office, used to process text or data, and linked to the computer system. Also called CRT's, referring to the cathode-ray tubes around which they are built.

"Scientific Management"

Although automation is presented in very "futuristic" terms, the goals and methods guiding the current stage of automation are shaped by management ideas which date back to the 19th and early 20th centuries. Two writers whose theories laid the basis for the predominant management belief that increased productivity and efficiency result from job rationalization are Charles Babbage and Frederick Winslow Taylor.

Charles Babbage, the great grandfather of management "science", wrote On the Economy of Machinery and Manufactures in 1835. He is credited with establishing the key principle that manual and mental work should be separated as completely as possible, in office as well as factory work. Generations of managers to the present day still rely on conclusions drawn from Babbage's book. The main tenets of "the Babbage Principle" can be summarized as follows:

> "1) the labor of educated or better-paid persons should never be 'wasted' on matters that can be accomplished for them by others of lesser training and 2) those of little or no special training are superior in the performance of routine work, in the first place because they 'can always be purchased at an easy rate' and in the second place because, undistracted by too much in their brains, they will perform routine work more correctly and faithfully." 5/

But it was Frederick Winslow Taylor who developed the methods of work analysis based on time and motion studies which we know as "rationalization", "scientific management", or simply "Taylorism". Work is broken down into identifiable, measurable units. Taylor, who is best known for his studies of auto workers on the assembly line, had a field day when he got to the office. Just one example of his findings: Taylor discovered that to make a cut with a pair of scissors, it should take a clerk 44/100th's of a minute -- with 3/10th's of a minute for each additional snip! 6/

We may wonder at the use of such minute data, and at the money spent on efficiency experts and production consultants. The sheer research involved in stopwatching how long it takes a clerical worker to snip with a scissors and the supervision required thereafter to see that she doesn't become slack in her snipping seems absurd. But top managers were convinced that they needed a corps of supervisors to monitor every move of the clerical workforce.

Rather than finally fading from the modern office, the methods of job rationalization are experiencing a revival. In fact, the most advanced stages of office automation require that office work first be made standard and routine by rationalizing all procedures.

"When we talk about how computers are changing our jobs," says author Joan Greenbaum, "it's important to realize that the jobs are changed before the computer comes in the door. To computerize what you do, managers must first find out exactly what decisions you make. First, an efficiency expert comes to set up new procedures which are designed to take your knowledge of the job and put it within the scope of computer programming. Then the computers and VDT's are brought in. It's this removal of decision-making from us to management and to computer processing which makes us first of all more expendable and secondly easier to control."7/

Automation of Office Procedures: A Case Study

Citibank is developing one of the most advanced computerized workplaces to date. Recently, Senior Vice President Richard J. Matteis described how the bank went about rationalizing and automating the letter-of-credit department. What follows is a summary based on a presentation by Mr. Matteis which appeared in Harvard Business Review. 8/

In June, 1975, it took Citibank three days to process a letter of credit request, and required over thirty processing steps, involving at least fourteen people acting on papers in six files. Today it takes only one individual with a video display terminal on line to a minicomputer-based system, working from a complete "cockpitlike" workstation with records filed electronically. The request is answered the same day.

It took the bank sixteen months to completely automate the process. Bank managers and production consultants (borrowed from manufacturing companies) held daily conferences with employees to find out exactly how they did their jobs. They matched what the clerical employees said with descriptions in management manuals, and found that the employees were making decisions not contained in the management guides (for example, solving unusual problems). Then they set up a laboratory within the office, called "the White Room", where they tested real vs. written procedures using a seven-year clerical veteran of the department.

The major staff reduction occurred within the first three months. More than a year before automation, Citibank reduced the department workforce from 142 to 100 employees. "Yet the (initial) figures only reflected the more significant achievement of a clean, efficient operation that was ready to be automated."

III. OFFICE AUTOMATION AND WOMEN'S EMPLOYMENT IN THE 1980's

The Current Status of Computer Use

In the early 1950's there were approximately 1,000 computers in the United States and microprocessors did not yet exist. By 1980, analysts estimate that over ten million microprocessors will be in use in the United States alone.

The widespread use of the computer has been made possible by the introduction of microprocessors in the 1970's. A single "computer-on-a-chip" in 1985 may have 25 times the capacity of a computer which filled an entire room 15 years ago. In 1979, I.B.M. reported that it can produce a chip containing 256,000 "bits" of information.9/

While the power of computers has been magnified, microprocessors have reduced computation costs 100,000 fold since 1960. In fact, if computers are compared to cars in terms of cost and technology, M.I.T. estimates that the production of a Rolls Royce would cost $2.50 and the car would run for 312,500 miles on a half gallon of gasoline.10/

Expansion Expected in the 1980's

The most advanced devices of office automation are already used extensively in big corporations (especially multinationals), the offices of the federal government, and financial institutions. An informal survey of 108 large companies found that 70% of the companies already use word-processing in combination with facsimile transmission or "electronic mail".11/ A majority of the companies have plans for more thorough automation to create their own offices of the future.

In addition, medium and small businesses are now introducing office automation, thanks to minicomputers. According to Technology Review, sales of small business computers are expected to triple by 1984, creating a $10 billion market. If total computer sales continue at their present annual growth rate of 12%, the computer industry predicts that its revenues will be the largest in the world by 1990, outstripping both auto and oil giants.12/

Technology: Present and Future

Office technology already claims impressive achievements. For example, the White House is the "testing atmosphere" for Xerox's Advanced Multi-Function Workstation, code-named "Alpha", which consists of a copier with a keyboard and video display screen. "Besides enabling the user to do electronic editing of documents before they are committed to paper, the system can also create charts and graphs from keyboard instructions, print letters in a variety of type faces, electronically store 1,000's of pages of information and print paper copies of graphs created on display screens." The computer to which "Alpha" is linked can simultaneously handle 254 more of these workstations.13/

The speed and viability of "electronic mail" has increased. In 1979, approximately 200,000 facsimile transmission units were used, sending messages at an average speed of 20 seconds per page. Average cost per message via electronic mail was $1.25 last year and is expected to drop to 50¢ by 1982.14/

Last year, a "paperless office" was set up in Washington,D.C., sponsored by 17 data-systems companies. One of its purposes -- to make it possible for executives to experience the electronic office without "secretaries as barriers to the system." By 1990, many believe, most record-handling will be completely electronic.

The computer industry, its engineers and advocates foresee advances which seem unbelievable today. Some say that by 1988 computers will be able to enter spoken (as opposed to typed or keyed) information. And desktop video-display screens are expected to speak and respond to verbal commands within 10 to 15 years.15/

Clerical workers will be more affected by widespread office automation than other sectors of the white collar workforce. Clerical employment is the largest sector of the workforce, and the U.S. Department of Labor predicts it will be the fastest-growing occupation in the 1980's.

Employment in the "Information Age".

We are already living in an "Information Economy", according to Mark Porat, researcher for the U.S. Department of Commerce's Office of Telecommunications. By 1955, Porat says, information-related jobs had already surpassed manufacturing in the number of employees. The Department of Labor estimates that 50% of today's workforce is employed in the "information sector" including electronics, communications and office workers.16/

I.B.M. estimates that by 1985, 40% of the total labor force will work in jobs primarily involved in information-processing. Earl C. Joseph, staff consultant/ futurist for the Sperry Univac Division of Sperry Rand Corp., goes so far as to predict that "by the year 2029, 80% to 90% of the entire workforce will be in jobs that involve the accumulation and processing of information."17/

Women Will Be Hardest Hit by Office Automation

Over 50% of the 20 million new jobs projected to 1990 will be in white collar work: managerial, professional, technical, sales and clerical. The Department of Labor expects clerical work to grow more rapidly than any other occupation in the 1980's -- with 4.8 million new positions in jobs dominated by women.

As women entered the workforce in record numbers in the 1970's -- at a rate of one million a year -- clerical work became increasingly "feminized". In 1950, 62% of all clericals were women; by 1970, 74% were women; today, a full 80% of clerical workers are women. 18/

By the end of 1979, clerical workers numbered 18 million, equal to 18% of the total laborforce. Clerical employment accounts for 35% of the country's 42 million working women, according to the Bureau of Labor Statistics.

A report by Siemans, the West German high technology firm, estimates that 40% of the work done in today's office is suitable for automation by 1990. A reduction in labor requirements of 25% to 30% would result if such thorough office automation were achieved, according to the Siemans estimates.19/ Of the estimated 3.5 million offices in the U.S., about 1.5 million are considered large enough for some form of office automation.20/

The occupations which are especially targeted for automation -- file clerks, bookkeepers, secretaries and typists, bank tellers and insurance workers -- are all at least 90% female. Already these jobs are being fundamentally changed. Women occupy the majority of low-level data preparation and text-processing jobs necessary to the smooth functioning of current and future automation. Because of this, they are on the front line of the new wave of automation in the 1980's.

IV. MANAGEMENT'S IDEA OF THE OFFICE OF THE FUTURE IS A RECREATION OF THE FACTORY OF THE PAST

The "Office of the Future"

What will the "office of the future" be like? "Electronic", "paperless" and as "people-less" as possible according to many automation advocates. Units with desktop terminals will replace the desk and typing stand. File cabinets will be nowhere in sight. Interoffice memos will be composed, edited and filed by computer terminals which can "talk" to each other. Letters and documents can be sent by electronic mail across the country or around the world in a matter of minutes.

A prevalent business vision of the "utopian" or "ideal" office is based on I.B.M.'s word processing plan, already introduced in many workplaces. "In the office of 1985 ... there are no secretaries. You receive services from a pool shared by several managers in your group; we call this pool the Administrative Support Center. Within the Support Center, there are Administrative Support Specialists, Information Storage/Retrieval Specialists and Word Processing Specialists."21/ Professional and managerial personnel are divided into groups of four to eight or more. Each group of "principals" or "word originators" is served by a clerical member of the specialized centers.

In its most rigid form the plan calls for eliminating all secretaries, from the chairman of the board on down, removing typewriters from everyone but "Word Processing Specialists", and forbidding anyone to answer the phone until the "Administrative Support Center" determines who should receive the call.

I.B.M.'s plan is such an affront to traditional working relationships in most offices that employers have found modifications necessary. Managers are allowed to keep their secretaries, secretaries are allowed to keep their typewriters and "decentralized workgroups" are introduced which are little more than smaller clerical pools for each department. The goals underlying the plan are preserved even if it takes more time to bring about "the end of the social office", and the maximum removal of decision-making from clerical employees to management via sophisticated computer systems.

By reducing the skills involved in office jobs, managers plan to reduce labor costs while increasing the amount of work each employee does in a highly supervised center. Companies often try to convince their employees that the new systems are better for everyone. In a study of five large employers in New England, a clerk at a public utility told sociologists Evelyn Glenn and Roslyn Feldberg:

> "When they set up the administrative services center, they said it was more democratic. We wouldn't have 'bosses' anymore, just 'clients'. But

they were just trying to save money. A clerk gets $150 a week while a secretary gets $185 for serving just one person."22/

Management Wants Greater Control

The first step towards the "office of the future" is to apply the principles of factory production to office work. The move to electronics finally gives managers "a way to enforce discipline and standardization in the office" explained one participant in a recent brainstorming session of computer vendors, users and consultants.23/ A "bonus" of office automation is that "business can finally monitor and measure the clerical function," according to Donald C. Vednais of 3M Corp's Business Communications Products Division.24/ In fact, companies can "eliminate unnecessary managerial layers" of supervisors "whose primary activities are monitoring others" by using machines designed to measure the output, speed and errors of each employee.25/ "The real payoff comes because managers are able to widen their span of control" -- to increase the number of subordinates they can manage.26/

"Computer-Controlled" Work Standards

Many computerized systems are designed to make it easier to enforce production quotas and the speed of work."Automatic call distributors", for example, are widely used in the insurance industry and in other companies with departments where clericals "process" phone calls from customers. The device simultaneously tallies the number of calls each clerk handles, measures the average delay in answering calls, and counts the calls lost by the switchboard after 30 seconds of ringing. Time standards often set the pace for every clerical job within the insurance company: "coding each A-type claim is alloted 4 minutes, a B-type claim 4.7 minutes. Each clerk keeps a running record of the work she does on a production sheet" by task and day of the week.27/ Computer terminals used by data entry operators record the number of keystrokes per minute and lines processed per day. Many of these "input typists" are paid piecework rates rather than an hourly wage. For claims processors, each claim is coded with the employee's name. The computer rejects any inaccurate forms, keeping track of the number of mistakes along with volume and speed.

All of these measurements become part of each employee's work record, often without his or her knowledge. While many clericals today have to write down what they do on weekly clipboards, more and more of these time-study calculations will be computerized. Many more clericals will be monitored and measured for the first time in the near future.

Companies Are Choosing Machines Over People

Automating the office also means shifting office costs from personnel to equipment -- adding expensive 'capital' equipment to increase what each employee can do to reduce the number of people needed to do more work. At Citibank in New York, in order to "attack the labor-intensity of the business", the management says it had to first "recognize that the back office was really a factory not a clerical function". This involved changing the distribution of office costs:

> "During the 1960's, hardware and software represented only some 10% of our total processing costs. All other expenses equalled 90%, labor alone accounted for a full 70% of the total. The issue was to flip the ratio entirely, to stand it on its head until labor

costs and other operation costs constituted only 30%, while hardware and software made up the rest."28/

Managers see several advantages to "flipping the ratio" from people to machines, advantages which compensate for the expense of investing in new office technology. For one thing, the cost of computers is declining at a time when clerical workers are demanding better pay, promotions, better benefits, and attention to health and safety -- demands which computers will never make. According to business and computer journals, "frequently disgruntled workers" whose "low productivity" does not justify their "disproportionate wage increases" and whose "changing social attitudes" have brought about "legislation for equal employment directives" provide the major incentive for office automation. "This climate is almost forcing the revolution of automation into the office," Xerox executive Robert E. Varrando told Business Week in 1975. 29/

The qualities which make machines more attractive than people in management's eyes are summed up in a recent advertisement by a company which manufactures industrial robots:

"Help Wanted"

> "Versatile workers to improve productivity. Willing to work days and nights. No vacations or sickleave. Job environment may be tedious or hazardous. Must have perfect vision and concentration -- applications unlimited. Call personnel." 30/

That robots and computers will never attend union meetings or go on strike is a point well noted by industrial and office management.

The virtues of robots in the factory hold true for computers in the office. "A computer can work for longer periods at a stretch than a human operator who gets tired and bored..." writers point out.31/ For example, with an Optical Character Recognition Scanner, used to process checks, "we can now do in three steps what it used to take seven steps and 25 or 30 more employees to do," explains Frank Benson, Director of the Treasury Department at Commonwealth Edison in Chicago. The scanner passes over the check, notes the date on the back, records the transaction in the central file and deposits the check in the company's account. Benson adds, "Long after the remittance staff has gone home for the day, the main accounting computers update the permanent records."32/

Clericals Face Increased Shiftwork and Piecework

For the computers to continue processing checks into the night, there must be people to operate them. Big banks frequently establish operations centers where hundreds of employees keep the equipment humming all night so that the bank can maintain fast customer service by day. Shiftwork is likely to become more widespread as companies strive to get the most out of the new machines, while they keep clerical wages, the "variable" among "fixed" costs, as low as possible.

In addition to shiftwork, companies are experimenting with having computer work done by employees at home - a return to the cottage industries of the 1880's.

"Portable terminals allow people to work at home, on the road or even in a mountain cabin. Workers are now being offered a much freer lifestyle", announces a management consultant on office automation.[33] "These terminals will be a special aid to homebound workers, such as mothers with young children..." concludes U.S. News and World Report -- and then shows us a picture of a commodities investor lying on the beach with his computer terminal alongside him on the blanket, following the stock market.

Portable terminals are more likely to mean piecework (pay-per-line-of-information-processed) for homebound clerical workers, rather than a "freer lifestyle". With piecework for part-time employees working at home, employers accomplish the same goals. Speed is self-enforced because the employee only gets paid by the end quantity and part-time employees rarely receive the same benefits as fulltime workers, nor are they in a position to seek raises or promotions.

Social Isolation and Less Freedom of Movement

The majority of women clericals are likely to continue to work in office buildings rather than at home. These future office workers could become as physically ly restricted as their blue-collar counterparts on the assembly line with the introduction of conveyor belts to move documents and files, predicted by U.S. News and World Report, and "cockpitlike" modular workstations, increasingly popular in use.

Whether inadvertantly or by office design, modular workstations tend to breakdown interpersonal communications between employees while facilitating oversight by supervisors. A video display terminal (VDT) typist and member of the newspaper guild says:

> "I work at a terminal all day. When the union pushed the newspaper company where I work, they improved the colors and lighting and all that for the fulltime operators. Now they have a new set-up called "the open office". There are panels six feet high around all the operators. We're divided into workgroups of 4 to 6 with a supervisor for each workgroup. In many cases, we don't see another person all day except for a ten-minute coffee break and lunch time. All we see is the walls around us and sometimes the supervisor. The isolation is terrible." 34/

Even in conventional office set-up's -- as opposed to "pooled" arrangements or "open plan" offices -- computerization usually means each clerical employee is more restricted. "Although a clerk may be less directly supervised, she does not gain autonomy," Glenn and Feldberg found. "The requirements of the machine replace the directives of an immediate supervisor." Divisions may be reinforced by physical separation:

> "Clerks rarely move around to observe workers in other parts of the building. Messengers deliver and pick up communications. At Big City Insurance, clerks must stay at their desks except during designated break periods. These arrangements are defended on the ground of efficiency. However, they also limit worker's opportunities to form face-to-face relationships with other workers."35/

Automation Provides An Opportunity For Management To Reorganize The Office

Managers can use the introduction of new technology as a means to achieve increased centralization of the workforce and specialization of jobs, trends which are not new at all. "Technology has little to do with office automation in the long run," says computer specialist Dr. James Carlisle of the Office of the Future, Inc., "...the processes of importance are management and control."36/

Dr. Marvin Sirbu of M.I.T.'s Center for Policy Alternatives recalls a presentation at the 1980 Office Automation Conference which makes it clear that the drive towards centralization is in some ways more important to management than the use of more efficient technology:

> "The company already had secretaries in a typing pool when they gave the secretaries word-processing equipment. A study found that 90% of the saving was from centralization; only 10% of the increase was from the new equipment. In other words, the results of the new equipment are often not attributable to automation but to the reorganization. In this way, the technology's not totally neutral, it's the way in which it is used. Office automation is both an excuse and a cause of reorganizing work."

V. THE MAJORITY OF WOMEN OFFICE WORKERS' JOBS WILL BE DEGRADED, DESKILLED, AND DEVALUED

In the near future, the major problem women office workers face is the degradation of their work and working conditions. The particular effects of automation will depend on the nature of the job, the industry being computerized, management's intentions in restructuring jobs, and the ability of office workers to influence the use of the new technology.

The New Technology Could Be Used to Improve Jobs

Innovations in computer hardware and software present opportunities to increase enjoyment in clerical work. Jobs can easily be designed to involve greater variety, as an individual gains mastery over the full range of what can be done with a versatile computer terminal. In fact, if applied with increased job satisfaction in mind, a study for the International Labor Organization (I.L.O.) points out, "computer systems have the potential to eliminate almost any excessively routine tasks."37/

Some jobs will be improved by the introduction of computerized equipment. The ease of proofreading and correcting copy without undue retyping is a welcome relief. In law offices, for example, estimates are that a finished court document is retyped six times on average when conventional typewriters are used. With text-editing equipment, the full document need only be typed once, with corrections keyed in as the draft is revised.

A woman who has worked on new equipment in a computer research environment writes: "Electronics communication and text editing, just as examples, are truly marvelous features. In fact I wouldn't want to do without them now that I have them, they make my working life so much richer and more fun."

Computer companies and consulting firms typically set up their own offices with the very best and newest automated systems. Such environments help both sales and research and they often demonstrate the potential for real job enrichment. For example, in one "research environment":

> "Many of the research secretaries here have taken up programming after realizing that this is something that they too can do. Fancy, computer text editors (that make word processors look feeble) enable a secretary to become a layout artist and format expert, and to experiment with designs due to the quick response of the equipment and the storability of older versions."

Optimists genuinely point out the positive qualities of automation. But the I.L.O. study notes that, unfortunately, most of their optimism is based on laboratory research rather than observation in private industry. "More pessimistic assessments seem to be based on experience", the report concludes. After several workplace investigations and a thorough review of research on data entry jobs, Professor James C. Taylor writes:

> "Central to the trend of increasing computerization of work is the increase in the division of labor and job specialization. This trend has been so pervasive that it is commonly said that office work is rapidly becoming as fragmented as assembly-line work in factories. This is especially true in those jobs in which a keyboard is used to enter various kinds of data into automated systems. These jobs are found increasingly in typing pools, word-processing centers, key punch and other electronic data processing input jobs."

Yet businessmen frequently extoll the virtues of the "computer age". That "the technological revolution is easing the drudgery usually found in America's paper factories" by "creating more stimulating careers for office workers" is a common claim. 38/"Showcase" examples by management tend to ignore the effects of automation on most clericals. By blurring the distinctions between classes of employees, advocates try to give the impression that automation upgrades all jobs.

For example, when Citibank automated its letter of credit department, a small number of clerical workers were reclassified as professionals. "The individual who used to be a clerk with a green eyeshade is now, at Citibank, a first-line professional" whose "job equates to the institution's mission" according to management. Jim Mayer, a clerk in the department for ten years, is presented as a glowing example:

> "I could see the automation could help make the job easier. Maybe automation puts some people out of work, but it only puts them out of boring work. It's given me a better job, more responsible."

Automation at the Citibank department only put Mayer and a small minority of employees into better jobs. We aren't told what happened to the many clericals transferred out of the department, although we are given the clue that some are not too happy in their new jobs. 39/

The belief "that it's the boring and repetitive jobs that get computerized, leaving room for more glamorous and exciting jobs" is one of the most prevalent myths in computer lore, according to Joan Greenbaum, a veteran of three decades of computer programming and author of the recent book, In the Name of Efficiency. "The fact is that it's not only the repetitive jobs that have been automated, making more room for creative jobs, but it's all the jobs across the board."

Potential Benefits Undermined by Management

Managers are using office automation to make the majority of clerical jobs routine and repetitive. I.B.M.'s motto, "Machines Should Work, People Should Think", obscures the systematic effort to take the thinking out of the work in order to increase each person's speed. Most women office workers will find themselves in jobs which are closely supervised and increasingly "specialized" -- meaning that they do ever smaller fractions of the larger task. Each job thus requires less training, and offers less potential for advancement.

Because of management choices about how to use office computers, the vast majority of women clericals will have little chance to experience the potential benefits of the technology. In fact, office automation as it is being introduced today requires that a great many people tediously enter the data, push the right buttons, fill out forms "for the computer" with perfect accuracy, and feed the forms to the computer. Each worker must discipline herself to the system imposed by the machine. Most often, clericals work with computer terminals which have been strictly programmed to perform only one task. One woman expresses the frustrations of many more office workers when she says: "I feel like asking my boss, 'What do you think I am -- an extension of the machine?'"

Low-Level Jobs Abound -- Skilled Jobs and Trained Employees are Displaced

Contrary to business assertions that automation means better jobs, studies have found that the proportion of low-level clerical jobs tends to remain the same or increase. 40/ A Federal study in the 1960's found that 70% of the new automated jobs in a large bank were low-rated and that one bank reduced the average pay for certain clerks by 22% after automation. 41/ In the insurance industry, government statistics show that clerical workers still represented about 50% of the workforce at the beginning and end of the 1970's, in spite of rapid introduction of automation. 42/

Employment in interchangeable data entry and information processing jobs and computer operator jobs is already absorbing the work of many file clerks, typists, keypunch operators, bookkeepers and all-around bank tellers. The work of file clerks, for example, is often transformed into a semi-automatic procedure of placing documents or forms under high-speed photographic machines. While semi-skilled clerical jobs abound, skilled occupations are being eliminated and trained employees displaced.

An insurance worker explains what happened at her company:

> "I used to be a keypunch operator. The company wanted to downgrade the keypunch operators, so they announced that they are calling the job 'data entry processing' so that the people who work it become 'data entry technicians'. In this way, they could get around the job classification. They take clerks, train them on the data entry machines and thus eliminate the keypunch operators. Because they're making

> keyboards that look like adding machines, you don't have to have that much knowledge to do the work. They still need some keypunching though, so they budgeted the keypunch operators at 7½ hours a week. part-time."43/

In many ways, automation is being designed to destroy the very aspects of work that most clerical workers enjoy -- the variety within jobs, relations with co-workers, and the potential for training and advancement. I.B.M.'s Word Processing Plan calls for the elimination of the personal secretary, who performs the most varied job in clerical work, and is the highest paid. "The long term career secretary is probably going to virtually disappear," says Larry Wells, top consultant for Creative Strategies International, a California data-systems firm. 44/

Women in Automated Jobs Will Be Paid Less for Doing More

I.B.M. claims that "soaring clerical wages" are a major incentive for office automation, and cites the 68% increase in the average secretary's pay from 1965 to 1975. However, since World War II clerical workers have earned substandard wages. Between 1967 and 1977, the cost of living increased 86%. In 1965, the average secretary earned only $4,000 a year -- and was at the top of the clerical pay scale. Today the average clerical salary hovers around $9,000 a year, before taxes and social security are deducted. Nearly three million women clericals -- 28% of all those who worked fulltime -- earned less than $7,750 in 1979, before taxes. 45/

Automation is contributing to lowering pay for clericals. In banking and insurance, among the most automated industries, wages for clericals are 8% to 19% below national averages by occupation, according to the Department of Labor. By February, 1980, the spendable weekly earnings of nonsupervisory workers in finance and insurance were worth only 70% to 77% of real wages in 1967. 46/ A panel of experts assembled by the insurance industry to predict prospects for business growth in relation to technology, predicted that clerical wages in insurance will still be below the national averages in the year 2000, while all other insurance occupations will be paid better-than-average salaries. 47/

Across the country, clericals working at video display terminals averaged only $7 a week more than conventional typists in 1979. In many Sunbelt cities, they earn even less than typists. For example, in Atlanta the average typist/clerk earns $8,268 while the average VDT operator earns $100 less; in Birmingham the average VDT operator earns $7,332 while a typist/clerk earns $7,436. 48/ This is in spite of the fact that numerous studies show that secretarial productivity increases from 25% to 150% when word-processing equipment is used, with the average increase measured at 130% according to a report by the International Federation of Commercial, Clerical and Technical Employees (F.I.E.T.). 49/ Some computer vendors and consultants claim that document production can be increased from 200% to 500%, mainly as the result of reduction in retyping and proofing time. 50/

In one state's government offices, about half of the 450 clerical workers reportedly spend eight hours a day at display screens and are required to fulfill quotas of 1,000 to 10,000 items per hour depending on the type of "inputs" they "process". The new quotas greatly increase the speed and amount of work each employee must do, but no one receives a penny more in pay as a result. Anyone who fails to keep up gets a poor service rating. 51/

Managers Are Deliberately De-Skilling Jobs

While there are some administrators who are trying to use new technology to improve clerical jobs, most managers prefer deskilled jobs because they want to keep clerical wages as low as possible.

The majority of managers cling firmly to the belief that efficient office automation involves close supervision of clerical workers who perform singular functions on equipment designed to maximize high-volume and speed. As one management writer puts it, "The question...is not whether to specialize or to continue with generalized positions. The question is: 'To what extent should or can office positions be specialized (narrowed) without resulting in the problems so frequently expressed by production employees today?'"52/ The problems which concern the writer are those that hurt the continuous flow of business -- "absenteesim, turnover, poor quality control or employee sabotage."

VI. SEX DISCRIMINATION CONTINUES IN THE NEW HIERARCHY OF THE COMPUTERIZED OFFICE

Automated office systems are creating "new" office hierarchies, which maintain sex-stratification in pay, power and prestige long familiar to women office workers. Women are concentrated in the computer-based clerical jobs, and in the lowest levels of the newly emerging computer occupations.

Automation Maintains Sex-Segregated Jobs

The computer era, it is sometimes said, offers vast opportunities for women, although Business Week notes this is one of the more "controversial" virtues of office automation.53/ While traditional clerical jobs are being improved by the addition of new computer skills, the arguement goes, the new computer occupations--programmers, systems analysts and computer operators -- hold tremendous potential for women. As technical and professional jobs within the office; computer specialist jobs represent a step up for clericals.

The very first operational computer, the ENIAC used to perform calculations for the atomic bomb in 1944-45, was successfully programmed by women. One hundred young women, with basic college training in math, were hired to do what was ironically identified as "clerical", and thus "women's" work.54/ Almost immediately, computer programming occupations were defined as technical and professional and became overwhelmingly male -- not because the women couldn't do the work, but because the social definition changed.

Only in the 1970's have women begun to enter (or re-enter) the non-clerical computer occupations in large numbers. Today they account for only 19% of all computer specialists. Women remain concentrated in the lowest-paid computer jobs as applications programmers and coders.55/

The influx of women into computer specialist jobs coincides with management efforts to standardize these as well as clerical jobs. The very features which make computer jobs attractive -- higher pay, high annual wage increases, advancement opportunities, and creativity and challenge in the work -- are the targets of management efforts. 56/

Women Dominate Computer-Related Clerical Jobs

Computerization affects all jobs in the office by reorganizing job duties. The bulk of computer-related clerical jobs are "data entry" or "information preparation" jobs.

In 1978, the number of electronic data processing and related workers was estimated at one million by the Bureau of Labor Statistics. However, this number does not include the many workers who retain conventional job titles although their work has been "automated".

The majority of computer-related clerical positions are held by women: 95.6% of keypunch and key entry operators; 75% of all office machine operators; and 62% of computer/peripheral equipment operators. Employment in computer/peripheral equipment jobs is becoming increasingly female. In 1978, 58% of these workers were women. Just one year later, in 1979, the B.L.S. found that 62% were women. An insurance survey in 1976 in 13 wage areas found that 100% of the key punch operators were women, and that minority women were particularly concentrated in these jobs. 57/

"Automated" Clerical Jobs Are More Dead-End Than Ever

A sociological study of five large employers in 1977 found that when computerization was introduced, the proportion of low-level clerical jobs remained the same, and that clericals were rarely upgraded to fill new skilled jobs. The study found that the automated clerical jobs were more mechanical and narrow, and that "the main avenues for clerical workers were either horizontal or downward." 58/

Office workers' organizations have pushed for accurate job descriptions and career ladders for working women. Often, managers use changes associated with automation to create ambiguity in jobs, to reduce the pay or to get rid of experienced employees who are better paid because of their long years of training. Tremendous job insecurity results when changes are introduced.

A woman with thirteen years experience at a financial firm worked as a secretary until eighteen months ago, when her company introduced new automated equipment:

> "All secretarial positions have been abolished. Some of the secretaries went into the typing pool as typists. The balance of the secretaries became, so the company said, administrative assistants. I now serve three vice-presidents and four paralegals. Just about 100% of the time is spent in filing, getting copies and running errands. The only change in the men's jobs is that they dictate into a telephone instead of a person. I asked my boss just what my job title was. I am certainly not an assistant or a secretary. He replied that I was somewhere in between! Today we were told that the Department of Labor is coming in but we cannot talk to them unless a company personnel member is present. Who is going to talk under that condition??"

The content of the majority of new jobs which result from the effects of office automation mean an end to advancement opportunities once possible for clerks, typists and secretaries. Their choices in work are often severely limited as variety and decision-making are removed. Glenn and Feldberg write: "A 37 year old clerk wanted to keep up her typing, but all of the typing was done in a separate pool. She did not want to type fulltime; as a result she never types at all. Under such circumstances, women can hardly develop new skills or even maintain their current onces." A woman who left her job in a word-processing center remembers:

> "One of the things I found most frustrating was that I wasn't allowed to correct the material I typed. No one recognized that I had a brain. So the verbatim came back upstairs and got sent back down to me for corrections."59/

Not only is the variety in their own jobs eliminated when they enter a word-processing center, but clericals are also cut off from contact with employees with different skill levels. Often the highest promotion available to them is that of supervising each other.

VII. OFFICE AUTOMATION, CLERICAL EMPLOYMENT, AND JOB LOSS

Even though employers have reduced their labor requirements, office automation has not reduced the overall need for clerical workers -- at least not yet.

Many office workers face fundamental changes in their work and many are being forced to change jobs and employers. The conception of office automation today is qualitatively different from earlier stages of electronic data processing, because of the focus on automating procedures as well as tasks. If the current direction of computer innovation continues, office workers who today use modern equipment to 'automate' routine aspects of their work may be automated out of their jobs altogether sometime in the future.

It Takes Fewer People To Do More Work

There is much debate on how quickly the job displacement effects of office automation will be felt. What is clear today is that certain occupations are declining and that industries are reducing their labor requirements.

Automation has changed the relationship of employment growth to increased volume in growth industries such as banking and insurance. In the 1960's the U.S. Department of Labor found that banks could handle the same volume of work with reductions in labor requirements of 40 to 50%.60/ In the 1970's the new wave of "technological changes have permitted the banking industry to meet sharply rising demands for its services with a much smaller increase in employment," the Bureau of Labor Statistics wrote in 1976.

From 1960 to 1973, banking transactions increased 8.3% a year, and employment grew at an annual rate of 4.5%. But from 1973 to 1976, employment growth slowed to 3.2% a year while banking transactions continued to rise sharply at 7.2% annual rate. By 1990, the Department of Labor estimates that employment growth in the finance, insurance and real estate sector will decline to 1.8% annual growth rate.

Examples of staff reductions and increased productivity are the stock and trade of business articles on office promotion. Citibank is one of the industry's favorite examples. The automated system, implemented in 1,000 offices with 5,000 more to go, has already resulted in "better customer relations, 50% better productivity and a 40% reduction in staff", Citibank officials told Fortune magazine in 1979. 61/

Lower-level managers are beginning to worry that their days are numbered -- and worry they should. In fact, top executives realize that automation gives them a chance to "reorganize from the payroll clerk all the way up." Citibank estimates that, in the near future, the bank will be able to eliminate 10% of its middle managers -- approximately 700 employees.

By its sheer size, the federal government provides an example of the computer explosion and its impact on employment. A 1977 report by the U.S. Controller General indicates that:

> "In 1950, the federal government employed two million people, had a budget of $40 billion and used two computers. In 1977, the budget had grown to $400 billion, but employment had only increased by 25% to 2.5 million people while by then the government 'employed' 10,000 computers." 62/

Certain Occupations Are Declining

The occupations which are declining tend to be skilled ones in which years of training on the job once meant entry into higher levels of pay and status. The skills of long-term workers, particularly of older women clericals, become irrelevant. For example, many secretaries pride themselves on their typing skills, but the "mag card" typewriter, which turns out one perfect letter after another, is on the way to making professional typing skills obsolete.

A woman in her 50's who had seventeen years experience as a top secretary and administrative aide, began looking for a secretarial position a year and a half ago, after divorce forced her re-entry into the job market. Today, she is still looking and cried in frustration, "Those mag cards and word-processors are just eliminating jobs!" Experience with computerized equipment is replacing traditional clerical skills as the necessary asset for landing a job. Computer courses will probably replace typing, stenography, bookkeeping skills almost completely in tomorrow's secretarial schools.

The Bureau of Labor Statistics found that there were only 1,200 banking employees classified as bookkeeping-machine-operators in 1976, compared to 18,000 such employees in 1960. Meanwhile, the trend among teller occupations is towards all-around and combined commercial/savings tellers, away from specialties as commercial, savings, vault or note tellers, who typically earn more than all-around tellers. 63/

Despite the decline in employment in certain occupations -- such as bookkeepers, stenographers, and many types of clerks -- and despite the reduced labor requirements of particular employers, the overall need for clerical workers is apparently absorbing the potential employment displacement effects of automation. Clerical work will be the fastest-growing occupation in the 1980's, according to government projections. Almost five million new jobs will be created for all types of clericals including bank tellers, secretaries, typists and receptionists as well as computer/peripheral equipment operators.

There are several reasons why clerical work is still a growing occupation.

For one thing, companies are at all different stages of automation, and some office procedures take more time to rationalize or make ready for automation than others. Secondly despite its repuration as the "solution to the paperwork nightmare", office automation has not yet made a dent in the volume of paperbased communications. Paper volume will increase at a rate of 10% annually for several years to come, according to International Resource Development. "Faster reproduction of printed materials will be more significant than the move from printed to non-printed communications in the 1980's," despite computer enthusiasts' hopes that most record-keeping and mail will be handled electronically by the end of the decade. 64/

In addition, automation just does not yet run as smoothly as the industry claims. Many bank and insurance employees spend their days correcting the mistakes which result from the use of automatic tellers or computerized claims forms. Countering I.B.M.'s slogan that "Computers don't make mistakes, people do", one bank worker put a sign over her desk which reads: "To err is human, but to really foul things up takes a computer." The new technology, hardware and software alike, is still being "debugged."

Management's Push For Labor Cost Reduction Could Lead To Employment Displacement On A Large Scale

The technology at this point is mainly influenced by what management wants -- and it is clear that computers are being sold by promises of reduced labor. "Debugging" is a matter of refinement, which will take time but can be realized. The potential for employment displacement is reinforced by the emphasis on "automation of procedures" rather than "mere mechanization of tasks" which characterizes the most advanced systems.

Employers and computer vendors find it advantageous to speak out of both sides of their mouths on the issue of employment impact. When confronted with fears of job loss, they will quickly point out the current inefficiencies -- that clericals are needed to correct mistakes -- or they claim that transfers within the company and retraining insure that no one loses their job. But among themselves businessmen swap stories of reduced labor requirements. In an article in Nation's Business, we find out why the road to automation, though difficult, is worthwhile: "The ultimate payoff," says Lawrence E. Mullen, of Allegheny Ludlum, Inc. of Pittsburgh, "is in dollars. If we were still using the old system, we would need 70 more secretaries at a payroll cost of $1.25 million." 65/

To shift office expenses from people to hardware and software, businesses will lay out large sums of money. Stanford Research Institute suggests that the average investment per office employee will rise from $1,000 - $2,000 today to $10,000 by 1985* at a total cost of $85 billion by the 1985-1990 time frame. 66/ In order to spend so much on automation, employers must be assured of "tangible economic pay-off's " observes a recent study on the status of the office of the future. "The return on their investments (in office technology) is the reduced cost of labor."67/

Two industry experts, Michael D. Zisman of Integrated Systems, Inc., and writer Richard L. Nolan, outline strategies for automation based on stages of computer use in the office. According to Zisman, in the middle stages "we begin to use 'automation' in the stricter sense of replacing people with machines." But he estimates that the technology to fully turn over office procedures to computers is still five to ten years away. In the meantime, managers will concentrate on automating labor-intensive activities, which will involve some "clerical replacement". But more importantly, today's forward-looking managers need to 'standardize' their office procedures to make future levels of automation possible.68/

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*compared to about $25,000 per average manufacturing worker.

Clerical labor cost reduction can only go so far. In spite of the wave of automation in the 1970's a recent study by Harvey L. Poppel, Senior Vice President of Booz, Allen & Hamilton, finds "a startling incongruity between enormous growth in automated office systems and a virtually nonexistant rise in office productivity' Poppel's findings led a writer for Computerworld to conclude:

> "There is only so much blood you can squeeze from a turnip...(If) only 20% of a secretary's time is spent typing, a 50% improvement in typing speed amounts to just 10% efficiency improvement."69/

The solution, suggests Poppel, is to move computer terminals into executive and professional suites, a move he calls the "bourgeoisification" of office automation.

Technology research is now geared towards creating "friendly" easy-to-use terminals for managers. Poppel and others believe that such a radical change won't be accepted "until executives can enter and extract information verbally, without having to use a keyboard."70/ If this happens, then many intermediaries -- clericals and computer programmers alike -- can be eliminated. In fact, veteran Xerox salesman Larry Wells predicts, "What can't be automated will be done by executives themselves or by part-time personnel."71/

Automated Unemployment Predicted

If the current direction of technological development continues, office automation could lead to employment displacement on a large scale. Studies in France and Britain predict enormous job loss in the not so distant future. A report prepared in 1978 for the French Ministry of Industry by adviser Simon Nora predicted that 30% of clericals in the banking and insurance industries could lose their jobs by 1990. 72/ British researchers Ray Curnow and Iann Barron believe that office automation could lead to permanent unemployment levels of up to 20% in England, where unemployment is currently about 5%. 73/

Ten other countries have initiated major studies on the effects of office automation in their societies. However, the U.S.Department of Labor has no method for calculating the impact of automation on employment projections.

The ultimate impact on employment cannot be separated from broader economic conditions and rates of industry growth. However, the dynamic of computer technology is against job creation in any sector where it is applied. The International Federation of Commercial, Clerical and Technical Employees (F.I.E.T.) suggests that "there is likely to be a cumulative employment impact hitting one sector at a time but building up over a ten year period." 74/ By relating projected productivity growth to office output, F.I.E.T. estimates that European office employment could fall 20-25%, potentially displacing five million secretaries and typists.

Computer advocates tend to ridicule and belittle fears about job losses.

"So much of what's been written on automation causing massive job displacement is reminiscent of the scary stuff written in the 1950's and it just didn't happen. We have yet to see the predictions of the 50's come true," says Dr. Sirbu of M.I.T. But an unpublished report for the Organization of Economic Cooperation and Development disagrees. The study concludes: "The evidence we have is suggesting increasingly that the employment displacement effects of automation anticipated in the 1950's are now beginning to arrive." 75/

VIII. OFFICE AUTOMATION MAY BE HAZARDOUS TO YOUR HEALTH

Evidence is mounting that the new equipment being used and the way work is being structured in the automated office pose serious hazards to the health of clerical workers. Areas of great concern are 1) occupational stress and 2) video display terminals (VDT's).

Occupational Stress

Recent studies show that women clerical workers already experience higher levels of stress on the job than men or women in most other occupations. Secretaries rank second-highest as victims of stress-related diseases, including coronary heart disease (CHD), according to a 1977 study by the National Institute of Occupational Safety and Health (NIOSH) of the Department of H.E.W. 76/

Recent findings of the Framingham Heart Study show that women clerical workers with children and blue-collar husbands are almost twice as likely to develop CHD as men. The study also found that women who work as clericals, regardless of marital status or family size, suffer nearly twice the rate of heart disease of all other working women. 77/ The authors of the study, Drs. Haynes and Feinleib of the National Heart, Blood and Lung Institute, found that secretaries, typists and other clericals who developed CHD were more likely: 1) to have an unsupportive boss; 2) to suppress feelings of anger; and 3) to experience few job changes. The researchers wrote: "These findings are consistent with observations that women clerical workers may experience several forms of occupational stress, including lack of autonomy and control over the work environment, underutilization of skills and lack of recognition of accomplishments."

The extraordinarily high risk of CHD (21.3%) among clerical workers with children and blue-collar husbands was interpreted generally as an indication of "economic stress". Two-third's of all married clerical workers have husbands who earn $10,000 a year or less. The majority of married women with children under 18 years of age are working. For all women with children under six years old, 44% are in the workforce -- 42% of mothers with small children who live with their husbands, and 67% of divorced mothers with small children. In general, one in three working women is employed in clerical work.

Job Dissatisfaction and Stress

Numerous studies cite job dissatisfaction as a cause of stress. Women are already twice as likely to be dissatisfied in their jobs as men, according to a government study conducted in 1971. 78/ The reasons given most often for job dissatisfaction by women office workers are low pay and the gap between expectations of training and promotional opportunities and the reality of dead-end jobs. Most of the problems which lead to stress and contribute to job dissatisfaction among clerical workers today are only increased as a result of automation.

A comparative study of general clerical workers and VDT typists found that the latter experienced extreme fatigue, alienation, monotony and lack of challenge in their jobs at twice the rates of traditional clerical workers. Symptoms of stress and increasing job dissatisfaction were most prevalent among "computer-controlled" typists paid according to piecework, and "de-qualified" office workers, who were transferred from more varied clerical jobs into fulltime VDT work. 79/

Scientists recognize that visual fatigue, nervous system fatigue and muscle strain are all related. Physical and mental stress cannot be neatly separated, but build on each other. Each of these forms of fatigue and stress is heightened in typical, fulltime automated jobs. In a British survey of office workers in mechanized jobs, 40% reported symptoms of nervous tension, depression, digestive and heart problems, insomnia, and irritability. 80/

Video Display Terminals

An estimated seven to ten million people work on VDT's, the key units of office automation. Between five to ten million units were in use in 1977, often used by a number of employees. 81/

Recent studies link VDT's to eyestrain, migraine headaches, nausea, lower and upper back pain and occupational stress. A great many of the problems have to do with low quality machines and improper workstation design, particularly poor or improper lighting. The lighting for conventional office work is completely inappropriate for work on a VDT, which requires much lower illumination and protection from glare. Many problems result from postural adjustments the operator makes to compensate for difficulties caused by poor lighting, low quality machines, illegible original copy, and poor workstation design.* These problems and problems associated with detrimental job design "are to a great extent within the control of the office manager..." according to a writer for a management research firm. 82/

Automation And Working Conditions

The introduction of computers, VDT's and other micro-image equipment intensifies the pace of office work in the name of productivity, while increasing the monotony and boredom in many jobs. In a report on data-processing jobs, U.C.L.A. Professor James Taylor found: "Fragmented jobs are usually located together, in the service of closer, direct supervision, to maximally utilize the capital-intensive equipment. The workers, all doing the same thing, work in parallel under pressure for high production." 83/

Word-processing equipment can process information at speeds up to 425 lines per minute, and can hold up to 100 pages of text with a single "floppy disc" (for memory). A device called a "prompter" makes it possible to program machines so that as soon as one typing job is complete, the next will come up immediately on the screen. 84/

New production quotas are set to conform to the capacity of the new machines, but additional rest or break time is rarely granted. 85/ Employees who work in computerized jobs complain of increases in production standards and speed-up in their jobs.

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* An excellent guide to proper lighting standards, workstation design, and criteria of high-quality equipment is now available from the New York Committee for Occupational Safety and Health, called Health Protection for Operators of VDTs/CRTs. See references for information on ordering. 86/

Janet Bertinuson, editor of the Labor Occupational Health Program Monitor, says that in the past six months, she gets two or three requests every week for information on the health hazards of VDT's. "Some people call in and report that their production quotas have even been tripled," Bertinuson reports. "Even when they have a union, the contract often states that management sets work standards, so that the employees can't file grievances on production quotas. Now they are challenging the quotas on the health aspects."

According to scientific research, 25% of secretarial/clerical workers who do conventional keyboard work (on typewriters, keypunch,accounting machines and VDT's) suffer from severe muscular distress in the arms, neck and shoulders, diagnosed as an occupational disease. The problems are significantly worse among VDT operators, and are exacerbated by rapid-work-pacing. 87/

In centralized Word-Processing, Administrative Support or Copying pools, employees are limited to one function -- making job rotation less likely -- and are assigned to serve many more managerial and professional staff than before -- which means "natural" break periods are eliminated. Some workplaces are being designed in ways that make job rotation seem impossible. One VDT typist says: "When we moved to a new, more modern building, they put all fifty of the full-time VDT typists on one floor -- by ourselves."

Job Redesign Is Essential

Studies indicate that break time and redesign of jobs are urgently needed if health risks are to be reduced. Job rotation is proposed -- to ensure that a balance of traditional office tasks and computer work is maintained to relieve constant sitting and repetition. Professor Taylor suggests the creation of work groups composed of workers who have many different skills:

> "The key is for such work groups to use the computer as an extension of themselves, rather than to be used by it. It is only when people are working together that they can see the relation of the many necessary tasks into a whole product, where they can learn from others, and they can progress along one of a variety of career paths while continuing to improve the skills and abilities they individually value most."

Unless occupational safety and health findings are taken into account, office automation will integrate stress-causing factors directly and permanently into clerical jobs. The health of clerical workers will be severely threatened by rapid-pacing of work enforced by computerized monitoring, increased job dissatisfaction due to loss of varied work and lack of advancement opportunities, and visual-,nervous-, and muscle-strain from VDT's and other computer equipment in poorly designed jobs.

Office workers in Europe and England have scored some recent successes. In Austria, the union which VDT operators belong to has demanded that a person can only be required to work on the machine for one hour at a time, with traditional office work being done in between. The British Postal Service's contract with the employees stipulates that "normal maximum periods at VDU's not exceed 100 minutes a day and that no operator be required to work more than fifty minutes without a break." 88/

IX. THE CURRENT DIRECTION OF COMPUTER TECHNOLOGY SERVES CORPORATE INTERESTS

Computer technology has the potential to create an improved quality of life and work. For example, many believe the micro-processor revolution could mean a shorter workweek so that people would have more leisure time.

However, because computer technology is being developed within the context of a highly competitive industry, it is controlled by companies whose primary motive is to ensure their own profitability rather than to further scientific advancement. The primary purchasers of the technology are the corporations who determine how it will be used in their offices. They have the most influence on what kind of hardware and software the computer industry chooses to develop and market. Management's overriding concerns with labor cost reduction and control of the workforce are reflected in technical and systems design.

The Computer Industry Controls Science To Suit Its Own Interests

Industry experts agree that nothing really catches on until I.B.M. gives a new idea its "good housekeeping seal of approval". "With I.B.M. and Xerox (the closest competitor) pouring out $1.5 billion yearly in R & D, they will control the pace of technology in their interest," an office equipment supplier remarked to Business Week in 1975. 89/ As the unquestioned leader in the business, I.B.M. holds the power to "legitimize" new trends. The computer giant controls 60% to 70% of the world market; its products penetrate sales of mini-computers thru satellite systems. Most competitive products must be designed in relation to I.B.M.'s strategies and hardware. 90/

Major computer companies in general, and I.B.M. in particular, are known to inhibit scientific progress for the sake of maintaining their extraordinary profit margin. I.B.M. will hold up the introduction of its innovations while it concentrates on setting up the optimal market conditions to make a killing. 91/ The biggest companies will squelch discoveries which threaten their multi-million dollar rental base (leased equipment) or which make recurring expenses (tapes, discs, microfilm/microfiche) obsolete. 92/

Since these companies can and do hold up the development of computer science in relation to the market, they are clearly capable of controlling the rate of technological change to insure that solutions are found to health and safety problems, detrimental job design, and potential employment displacement. Computer manufacturers and users must be made accountable for the effects of their products on individual workers and society as a whole.

For example, standards should be set for the manufacture of display terminals so that problems associated with low-quality machines are eliminated. Furthermore, companies already have the technology to manufacture VDT's without cathode ray tubes (CRT's) -- the source of radiation worries among innumerable workers.

Although radiation from VDT's has been measured within federal emission guidelines, no one really knows what the long-range impact of low-level exposure will be. Many scientists and labor officials fear that radiation dangers from VDT's will be proven in the future. One Newspaper Guild official told Working Women "This whole thing may end up like Three-Mile Island. We won't know the damage for another ten or twenty years." Manufacturers could use substitute technology now to remove CRT-based display screens from the workplace and avert potential health hazards.

Management Goals Influence Technological Design

While choices in manufacture of equipment demonstrate a disregard for workers' health and safety, choices in promotion of technical design reflect the interest of corporate managers in controlling the workforce.

A technician who worked on a secret project for I.B.M. in 1965-66 describes what the research team created:

> "We had perfected a device about the size of a writing pad which you could write on with a pen while walking around. Whatever you wrote on the screen went to the computer. In other words, it was a video-display screen -- but it was a VDT that wasn't in a fixed place and didn't have a keyboard. I.B.M. developed it, but they never took it out of the laboratory. Instead, they introduced VDT's which require that people sit in one place in front of a screen all day."

What VDT operators lost in terms of ease of use and physical mobility, managers gained in terms of supervisory control.

The evolution of office automation does not represent a disinterested "advance of technology", but rather the advancement of particular interests. Scientific invention is being defined to provide management with ways to reduce both the cost of employees' labor and, eventually, the size of the workforce. Office technology is being used to destroy the positive aspects of clerical work, while reinforcing the worst features . Corporate leaders encourage the development of labor-displacing technologies, without regard for the social consequences. The current direction of technological development is irrational in any but management terms.

X. RESISTANCE TO OFFICE AUTOMATION AND HOW MANAGEMENT RESPONDS

Employee resistance is considered the number one obstacle along the path to the fully automated office. "The willingness of office workers to accept changes and to discipline themselves to a new system" is more important in setting the rate of introduction of automation than the state of the technology itself. 93/

The unwillingness of secretaries and managers alike to go along with reorganizations dictated by top management is well documented in the popular and business press. High-level secretaries are in a relatively unique position to resist changes, since many managers do not want to lose their personal assistants, or the status which having one's own secretary symbolizes. "The biggest problem we face is the office wife," complains Lexitron executive Jonathan Pugh. 94/

A great many non-secretarial workers file their objections to automation -- by quitting. Extremely high turnover is a problem the industry would rather not broadcast. A researcher for one of the leading firms told Working Women:

> "Word processing was an initial disaster and still has 100% annual turnover because an oversimplistic view of secretarial jobs was the basis for reorganization plans that totally screwed up the jobs in many cases, changing secretarial work from a socially integrated environment into a production line where the class distinctions were more obvious and the opportunities for interaction far more limited."

Management Responses to Resistance

I.B.M. characterizes resistance to office automation, new technology, and reorganization as "people problems" provoked by the arrival of new equipment which breaks up traditional working relationships in today's relatively "unstructured" office. The more unstructured the office is to begin with, the more traumatic the introduction of new procedures and technology will be, and the more carefully resistance must be handled.

In the meantime, managers solve their "people problems" in a variety of ways. To some employers, the answer is to increase supervision of the clerical workforce. One such company gave a presentation on their experience at the 1980 Office Automation Conference:

> Along with the introduction of new equipment, the company centralized all word-processing. Supervisors monitor the operators, counting the number of lines they complete every day. Since the clericals only do word-processing now, the company reduced the pay scale. "We have had terrible problems of absenteeism and turnover," the company representative warned other employers. "You have to watch 'em every minute."

Outright reductions in pay are abuses which many companies find unnecessary. Another employer at the conference countered: "As soon as a secretary learns word-processing, we automatically raise the secretary's salary, because she has learned a new skill. We don't have any of these problems." 95/

Pepsi Cola Co. retrieved a disastrous word-processing venture as follows. Having set up a center with eleven secretaries for 200 managers, Pepsi's Vice President of Personnel, Edmond Piccolino, found that "The tension was unbelievable!" -- an observation that would surprise few people outside personnel management. But the company solved its problem handily by bringing in a supervisor "to keep the word-processing process personal", and encouraging managers to pay compliments to the members of the administrative support pool. Fortunately, the company also set up career paths for the employees in the center. 96/

Even when the worst effects of automation are softened, other problems remain. More often than not, job content suffers. For example, Security Pacific National Bank of Los Angeles installed a word-processing center in their legal department in 1972 and had to disband it a year later. R.A. Eliassen, a bank vice president, explained why: "All we did was to concentrate the drudgery for some secretaries and give others more time to run for coffee. It just didn't work according to I.B.M.'s grand plan." 97/

But managers' concerns are not always as "humanistic" as they sound. The bank vice president's real gripe, it turns out, was that "We were paying 14¢ a word before word-processing and 14¢ a word after." Four years after disbanding the center, Security Pacific hired another manager to re-centralize their information-processing. "You don't realize much in savings if a secretary types only two hours a day," Elio Rotolo, the new manager, told Business Week recently. And besides, he added, "managing people in centers is much easier than in scattered stations." 98/

More "Modern" Managers

Another firm followed I.B.M.'s plan, and realized a 30% reduction in secretarial staff but felt that "much was lost in the human factors area". The "human factors area" was then defined as "decreased management efficiency" resulting from the losss of one-to-one relationships between managers and secretaries. But rather than restore secretaries to their former positions, the solution chosen was to educate the managers to use the clerical pools more efficiently. 99/

Leaders in the forefront of automation have learned from experience not to move too fast or too radically. Companies are advised to "make showcases of the word-processing centers" as Citibank has done. "An attractive, smoothly operating center is important to the internal public relations campaign which is needed to overcome resistance at every level."100/

Some consultants, such as James Driscoll of the Sloan School of Management, advise that the office of the future should increase both the productivity and creativity of the clerical workforce. Driscoll then attaches a "political motivation" to the improvement of jobs with automation. He warns that managers who do not "automate nicely" will be at the mercy of "a highly volatile force in our society -- pressure in the form of unionization of clericals."101/

Besides giving managers "a way to bring standardization and discipline to the office", automation also provides management with opportunities to undermine office workers' right to organized representation. Too often, highly paid consultants brought in to ease the transition to automation play a dual role as anti-union or union-busting advisors. By disrupting job classifications and pay scales, employers can eliminate long-term employees whose occupations are automated. Unions in New York City report instances where company officials flatly challenge job titles, telling employees "You're not a file clerk anymore, you're just a machine operator."102/

It's only fair to say that there are many individual managers who are appalled by the prospects of automation, decrying I.B.M.'s strategies in particular as "a giant step backwards from job enrichment". But too often, they tend to see the changes as inevitable -- painful, but unavoidable.

Many computer specialists have resigned themselves to the fact that the office of the future may not be achieved with "this generation of managers and executives" at all. They look forward to the day in the near future when "society is adjusted to the idea of technology as part of everyday work and business schools are turning out graduates familiar with technology".103/

Corporate and computer industry leaders believe that efforts must be made to "increase the respectability of automation" if computers are really to penetrate public and economic life in the 1980's, and they are hopeful that the spread of computer games and home computers will help improve the computer's image.104/ Today there are about 100,000 computers in homes, but the industry predicts that "every child will have the opportunity to grow up with a computer in the future."105/

Although the pace of technological innovations seems overwhelming, office workers will continue to have a major impact on how quickly offices are automated. An I.B.M. vice president, William F. Laughlin, makes it clear that his company does not have endless patience with those managers or clericals who might resist the office of the future: "People will adapt nicely to office systems," Laughlin told

Business Week five years ago, "if their arms are broken. We're in the twisting stage now." 106/

Organizing for Real Alternatives: A First Step

A recent incident demonstrates the importance of office workers having a say in the introduction of technology. At a large financial organization, a department of about 300 employees wanted to bring in computer technology to solve workload problems and to improve job satisfaction. A group of secretaries and managers formed to explore the possibilities. They divided into three study groups -- one on the technology itself, both programming and equipment; the second, on the human factors, particularly health and safety issues; and the third, on the work needs of the department, to determine what technology would be best the handle the work demands.

After six months, all three groups concluded that they wanted the new technology to be introduced in a completely decentralized manner, so that the computer terminals and systems would serve the natural workgroups of employees which already existed. Such a system would be somewhat more expensive but the groups insisted that no secretarial lay-off's result. They pointed out that the time saved in faster turnaround and quality of work would spare the corporation the cost of a new top management position which would be required to run a centralized system.

When the conclusions were presented, the Office Technology Division of the company refused to purchase the new equipment! A representative of the Office Technology Division (which is directly accountable to the top management) said that only a centralized system would be acceptable. The secretaries and managers who had thoroughly studied the issues were furious -- they knew that their decentralized plan would meet the work needs and improve their jobs. If the Office Technology Division forced a centralized system, management's concern with control of the clerical workforce would be completely exposed. Within ten days, the corporate management backed down and agreed to consider the department's proposal.

The secretaries in particular are skeptical about the final outcome. Some think that the company will stall for as long as a year, hoping that their anger will fade. But they are determined to demand that new technology be introduced in their offices according to what they know is best to suit their needs. Top management and its Office Technology Division are faced with an angry, well-informed and organized group of employees, ready to fight for what they want. And the company realizes that, even if the managers resign themselves to a new system, the secretaries might rebel -- and organize even further.

XI. CONCLUSION: OFFICE WORKERS ARE IN A RACE AGAINST TIME

Multinational and financial corporations are leading the race towards the office of the future in the belief that office automation will guarantee them spiralling profits, a competitive edge in the marketplace, and a permanent end to "labor pains". Although a long range investment, automation is the ultimate corporate answer to the demands of office workers for higher pay, better working conditions, and equal employment opportunities for women and minorities.

Particular targets of the most advanced hardware and software are employees in the best-paid, most creative and varied nonmanagerial jobs. The jobs of employees at the low end of the pay scale are being downgraded and devalued, despite the potential the technology offers to improve these jobs. It is inexcusable for employers to use the very technology which could genuinely upgrade clerical skills to abdicate the responsibility to train employees for better jobs while companies complain of "the shortage of skilled personnel".

Today, microprocessor technology is being applied to both blue-collar and white-collar work in ways that reinforce the potential for major job displacement in the future. In the past, as employment in manufacturing began to decline, clerical and service employment grew rapidly. If employment growth in key service industries is slowed as a result of office automation, where will new jobs be created? Social needs are ignored by the computer industry and corporate leaders who strive for technologies which can eliminate ~~jobs~~ during the coming decade of high unemployment, severe inflation and economic recession.

Women office workers are in a race against time to protect their futures. Unless clericals organize to influence automation in the 1980's -- while the technology is still in its formative stages -- the health, well-being, quality of worklife, and employment of women office workers will be sacrificed for the sake of "corporate progress".

XII. WORKING WOMEN CALLS FOR ACTION

Working Women, the National Association of Office Workers, calls for the following actions to begin to reverse the negative effects of office automation:

1. Congressional Hearings to confront the computer industry and employers in a public forum, and to increase public awareness of:
   --the impact of office automation on the working conditions of clerical workers;
   --the health and safety implications of office automation, with special attention to occupational stress among women clericals and the problems associated with video display terminals;
   --management's attempts to use office automation as a tool of power to increase control over the workforce and to undermine the right of clerical workers to organize.

2. A Moratorium on Further Introduction and Manufacture of Video Display Terminals: Health problems associated with VDT's are well documented by medical research, and it is now clear that standards are needed to insure safe machine and job design.
   --The computer manufacturing industry has the technology and resources to develop safe equipment and must be required to do so.
   --Management's drive to speed up the pace of work, increase production quotas, and centralize clericals in information-processing pools, where they work at VDT's continuously for six to eight hours or more, must be stopped.

3. Studies by the U.S. Department of Labor to thoroughly assess the impact of automation in key industries such as banking and insurance. Studies must be designed in such a way that they do not rely solely on employers for data. Among the issues which require detailed analysis are:
   --the effects of automation on the pay scale, job descriptions, and promotional opportunities of women and minority employees already concentrated at the low end of the pay scale;
   --the particular impact on long-term and older employees, with attention to displacement or replacement of skilled, trained personnel;
   --the centralization, monitoring and machine-pacing of work;
   --the impact on the incidence of involuntary part-time and shiftwork employment;
   --the potential employment displacement effects of the technology.

Working Women also urges computer scientists and programmers to find out from clerical workers, their organizations and unions, how the hardware and software they design is being used by management in the workplace. We are encouraged that a panel on The Effects of Computerization: Three Views from the Shop Floor, which includes a representative from Working Women, will be part of this year's National Computer Conference to be held in Los Angeles, May 19-22.

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Ms. GREGORY. In the report we state our view that innovations in new office technology have a great potential to upgrade office jobs, office skills and pay, and to provide more avenues for job satisfaction among clerical workers. Yet we find, as many, many studies confirm, that the opposite trends dominate—deskilling, devaluing, and degrading of women officeworkers' jobs, a decline in promotional opportunities, potential for large-scale job loss, and increased health risks. These problems are documented quite thoroughly in the report.

I want to focus on a couple of newer issues. In the last year we have found instances where time-motion studies, literally those that helped design the assembly line, have been applied to video display terminal work. Such time-motion methods are inappropriate in information processing work.

Shiftwork and nightwork are becoming more common to get the most out of expensive equipment, and piece rate or pay per line of information processed is spreading. There is even now a clamor for office homework, a return to the "cottage industry" concept of old.

Managers are using production quotas and constant monitoring of work performance to carry out speedups of awesome proportions in large clerical operations.

When we look at it closely, we see that the much vaunted "office of the future" is little more than a re-creation of the factory of the past.

I want to describe a recent study, by Dr. Mary Murphree of Columbia University and City University of New York. Her study involves highly skilled legal secretaries in Wall Street firms.

As I entered the room this morning, I heard some of the discussion of whether these new innovations in technology increase skills or decrease skills. Obviously, there are dual trends. But I think that what occurred in this study of highly prestigious secretarial jobs is very noteworthy.

What Dr. Murphree found was that while early forms of office computerization tended to upgrade and assist secretarial worklives, current innovations are striking at the heart of the traditional legal secretarial craft and creating a number of serious problems.

Murphree noted a growing fear of "robotization," a term which the secretaries coined and expressed to her. Many of them said they resent sophisticated dictating equipment—increasingly standard in large firms—and centralized transcribing pools, which together make much prized and hard-earned secretarial skills such as speed stenography obsolete.

Dr. Murphree concludes "the study suggests that the most challenging and responsible tasks traditionally in the legal secretarial domain are being gradually transferred away from the secretaries to cadres of professional and paraprofessional workers, thereby reducing the secretarial function to one of merely telephone gatekeeper and exacerbating at great cost to the legal secretaries a caste-like system of nonprofessional employee."

Another more recent concern that is coming more sharply into view is the danger of polarization of the office employment structure, with highly technical jobs at the uppermost level, large numbers of deskilled jobs at the base, and a skills gap in between virtually impossible to bridge.

In another report of working women which we released this year, I described the increased health risks of office automation particularly those related to elements of the work organization that can increase job stress. In the report I also describe factors which researchers believe may mediate job stress and may counteract job stress. The report is called, Warning: Health Hazards for Office Workers [April 1981].

[The information follows:]

HEALTH HAZARDS FOR OFFICE WORKERS—AN OVERVIEW OF PROBLEMS AND SOLUTIONS IN OCCUPATIONAL HEALTH IN THE OFFICE

(Report by Working Women Education Fund, Cleveland, Ohio)

II. JOB STRESS IN THE OFFICE

Loretta works as a switchboard operator at a major insurance company in Cleveland. She developed coronary heart disease at the age of 27.

> "Fresh out of three years of college, with a background in accounting, the company assured me that the switchboard job was temporary and promised to cross-train me for an accounting job in the near future...Right after I began work, they asked me to fill in for awhile in the mail room in addition to my switchboard duties. I soon became indispensable to them, doing both jobs at once...Earlier this year, I took a two-week sick leave to recover from mono, but they called me back after one week, though I could barely walk up the stairs...I went to talk to personnel about a transfer or a training program. 'You don't have the experience to do other jobs,' I was told, 'and what is more, your attendance has been unacceptable.' He ignored my explanation that doing two jobs was making it difficult to recover from mono...Before I had this job, my health was excellent. But in September, my doctor diagnosed me as having a heart condition called atrial arrhythmia, which means that my heart beats irregularly, I get tired very easily and often have hot flashes and nausea. My doctor and I are both convinced that the conditions I am forced to work under have brought on this illness.
>
> So here I am, two years after having so confidently begun my career, still working at the switchboard, I am stuck in a dead-end job, my medical benefits are exhausted, I make under $10,000 a year, and I have permanently lost my good health."

A Stress Epidemic

Recent research is beginning to uncover a virtual epidemic of stress symptoms and stress-related disease among office workers. Millions of workers are affected. And because the symptoms do not end when the worker walks out of the office at the end of a day's work, the families of millions may also be affected by the problems caused by office job stress.

Furthermore, the trend toward automation in office work is exacerbating the very job factors found to be most stressful, while threatening to eliminate those aspects of the job which promote job satisfaction and counteract stress.

Within the last year, the public and the scientific community have been shocked into recognizing the high levels of job stress endured by women office workers.

* Results from the Framington Heart Study (February, 1980) showed that women clerical and secretarial workers developed coronary heart disease (CHD) --clearly identified as a stress-related malady--at nearly twice the rate of other women workers. 1/

* The National Institute of Occupational Safety and Health (NIOSH), studying the insurance office of Blue Shield in San Francisco, found higher levels of

job stress among operators of video display terminals (VDTs) in strictly clerical jobs than any other occupational group ever studied by NIOSH — including air traffic controllers. 2/

Surely stress has been part of office work for a very long time. But, today stress and its effects on health command increasing attention. Why? For one thing, the major causes of death in the U.S. have changed over the last century from infectious diseases to chronic killers such as cancer and CHD. Through research, scientists can demonstrate the role of a lifetime's exposure to stress at work in these diseases and many more. This formerly "unseen" or "hidden" hazard is coming into focus.

The new findings about stress among office workers came as a surprise; they are still met with resistant disbelief by many managers. One fact which helps to account for some of the surprise: before the 1970's, virtually all stress research was done with white men only. Women workers were not included in most studies. To this day, there is almost no research on job stress experienced by minority workers. Among white-collar workers, "executive stress" or "managerial stress" received a great deal of attention, while clerical and secretarial workers were ignored until recently. 3/

The combined roles of paid work and work at home for women, and the prevalence of hypertension among the black population are examples of "complicating factors" which led researchers to exclude these workers from previous studies. Now, these same factors lead many researchers to predict that they will find more harmful health effects from stress than were measured among managers or young, white male workers. In particular, race discrimination may act as a constant, underlying source of stress, adding a daily dose of hostility or isolation, or both, to each workday. 4/

Common Myths About Stress

There are many commonly held ideas about stress. The more we learn about occupational health, the more these myths break down, but they are still widely believed:

Myth #1: "People with great responsibilities who make lots of important decisions have the most stress."

Myth #2: "A person brings stress from home into work with them. If they're under stress, it's because of family or personal problems."

Myth #3: "Certain people are just more susceptible to stress. It's not the job; stress is a very individual sort of thing."

In the following pages, research on stress which disproves these myths will be reviewed, sources of stress in office work will be examined and strategies for reducing stress in the office will be discussed.

Stress Defined

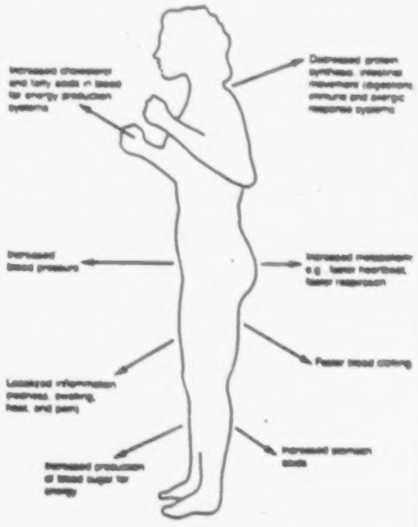
The "stress response" is your body's way of preparing to meet a physical, mental or emotional demand or challenge. Virtually every major system of the body is involved. A series of internal reactions occurs which includes:

> "...an increase in heartbeat and breathing rates, increased secretion of stomach acid, and release of hormones that affect metabolism. Emergency release of adrenaline occurs, as well as a rise in cholesterol and energy-rich sugar levels in the blood. More energy goes to your muscles, and the stomach becomes inactive. These are acute reactions to a stressor (a source of stress)." 5/

The body gears up to meet the stressful situation. This is often called the "fight-or-flight" response since the same physiological reaction occurs whether a person is excited or afraid. 6/ Some "stress" is good -- excitement, enjoyment, a challenging and interesting event will arouse the "generalized stress response." Without such stimulation, life would be dull.

It is chronic -- continuous or prolonged -- stress which poses a danger to health and well-being. Normally, the body returns to a state of equilibrium after meeting a challenge. But if the causes of stress remain constant, the body is kept off balance. The protective responses described above can become destructive, and health problems may result over time. "What the body can't cope with is day-in, day-out stress that has no reward or end in sight." 7/

Figure 1:
Aspects of the Stress Response


Increased cholesterol and fatty acids in blood for energy production systems
Decreased protein synthesis, intestinal movement (digestion), immune and allergic response systems
Increased blood pressure
Increased metabolism e.g. faster heartbeat, faster respiration
Faster blood clotting
Localized inflammation (redness, swelling, heat, and pain)
Increased stomach acids
Increased production of blood sugar for energy

Reprinted courtesy of Dr. Stellman.
From: Women's Work, Women's Health,
Ch. 2: "Work, Stress and Health."

In this report, "job stress" is used to refer to chronic, excessive stress or strain on the job, rather than the general stress response of the body.

Health Effects of Job Stress

"Extraordinary or continually unwanted stress costs us energy, deprives us of tranquility, facilitates the occurrence of some diseases and even outrightly causes others," writes Dr. Jeanne Stellman of the Women's Occupational Health Resource Center.

Exposure to stressful conditions at work over a period of weeks or months can lead to stress-related health symptoms and problems. If stressful conditions continue for many months or years, serious chronic illnesses can develop -- inclu-

including coronary heart disease, ulcers, spastic colon and hypertension. Migraine headaches, exacerbation of skin problems such as excema, asthma, cancer, joint inflammation and arteriosclerosis have also been linked to chronic stress. Longterm psychological reactions may occur -- depression, constant tiredness or malaise, or even a "nervous breakdown." 8/

It's important to realize that muscular strain, visual strain, nervous system strain, mental fatigue and psychological strain cannot be neatly separated from one another. These problems build on each other and can lead to a state of exhaustion, which increases a person's susceptibility to illness.

What a person does about anger, frustration or anxiety on the job -- and what a person can afford to do about health problems from job stress -- will also influence what happens to his or her health.

Stress and Disease

Chronic stress is known both as a "disease producer" and a "disease enhancer", whose effects are both systemic and specific. In relation to illness, stress can play a *direct* role -- as with ulcers or coronary heart disease -- an *additive* role -- aggravating diabetes, asthma, cancer or skin rashes -- or a *synergistic* role -- creating a combined health risk greater than two or more problems simply added together, as in the case of someone who smokes and is under stress. In studies of highly stressful jobs, excess rates of every psychosomatic disease that could be studied have been found. 9/ In other words, a stressful occupation increases the risks of many diseases which are affected by one's state of mind or feelings, which in turn have physical consequences.

In a study of 2,000 men in 27 occupations, researchers found that workers reporting gastro-intestinal problems, diarrhea, colitis and gall bladder problems also experienced higher levels of anxiety than co-workers. Anxiety was identified as the psychological strain most striking in relation to physical illness.10/

Job stress has different effects on different individuals. Some common *symptoms* include: nervousness, loss of appetite, periods of easy irritability, anxiety, chest pains, trouble sleeping (insomnia) and raised blood pressure. Headaches (especially migraine headaches), backaches, toothaches (from grinding teeth), spasmodic pains in the neck or shoulders, skin rashes, catching colds, viruses or other illnesses easily are also common symptoms of stress. Job stress can play a role in menstrual irregularities and in recurrent vaginal or bladder infections. Both men and women often experience sexual difficulties as a result of being under a great deal of stress.

Psychological Effects of Stress

Common effects on mood and feelings include: anxiety, depression, irritability, confusion, fatigue, boredom, guilt, anger or resentment, low self-esteem, a sense of hopelessness or feelings of worthlessness.

Researchers note that psychological stress reactions among office workers "tend to be mood disturbances and not severe psychoses". There is no evidence that clerical workers are at any greater risk of "psychiatric injury" than people in other jobs. 11/ But, being under stress can hurt relations with friends, co-workers and family members, making it harder to get help from others when it's most needed.

Effects on Home Life

Stress does not just come from the job nor does stress "just come from the home and get carried into work" -- as we often hear. Because chronic stress at work is likely to affect a person's self-image and relations with others, the effects of job stress last much longer than the hours spent in the office. Stress at work affects the family and friends of the employee under stress as well -- causing concern and worry for the person's health and state of mind, increasing the likelihood of depression, arguments or conflict at home, and adding to economic pressures with medical expenses.

The view that the main direction of stress is from work into the home is gaining acceptance. "Job stress may be a very personal experience, but it is by no means a private one," Dr. Elliott Liebow of the Center for Work and Mental Health of the National Institute of Mental Health explains. "It's crucial to realize that the stress experienced by the worker and his or her reaction to them -- depression, anxiety, anger, boredom, shame -- or respiratory, blood pressure or stomach problems -- that these things do not stay in the workplace. The worker takes them home, where they shape his or her relationship with his or her family and friends...These stresses are diffused throughout the community. After a while the worker, or members of his or her family become a statistic having to do with alcohol or drug abuse, physical illness, mental illness, family break-up, violence or something else. And then the worker may even become one of those 'troubled workers' who brings his (sic) problems with him into the workplace." 12/

A study of fatigue, nervousness and job dissatisfaction among women keypunchers concluded that "the subjective feelings associated with fatigue are delayed such that their major impact occurs after the work period is over."13/ Swedish research finds that people in "passive" jobs which allow them little control at work tend to be more withdrawn socially and less involved in civic activity than people in "active" jobs which allow more control over the pace and organization of work.14/

Harmful Side Effects of Stress

Increased cigarette smoking, increased use of alcohol and increased use of prescribed or unprescribed drugs are common responses to stress which can in turn become harmful "health effects" of stress. Instead of providing genuine relief, reliance on such means of "escape" from stress may only make matters worse.

Over the last decade, studies have shown an increase in the number of women workers who smoke cigarettes, while smoking among men declined in the 1970's. 15/ Scientists estimate that at any given time, at least 4 million people are taking tranquilizers prescribed by their doctors. 16/ While taking a prescribed "calming" drug such as Valium or Librium may help a person get through a hard working day, such drugs can have terrible effects on health. Alcoholism among women is receiving increased public attention.

Excessive drinking and drug use are often hard for women to admit or discuss, since they carry a certain social stigma. They are ways of trying to get away from the anxieties of frustations caused by stressful working conditions which will only make it harder to identify and eliminate the sources of stress.

While these are clearly ineffective or destructive responses to stress, women workers cannot always choose the best way to deal with stress symptoms. For working women, a major problem in dealing with health symptoms is low pay and lack of adequate benefits. Many of the respondents to the Office Workers Health and Safety Survey commented that they could not afford to take time out to see a doctor or to get away from their job long enough to relax or catch up on rest. (See Section VI). Many women also commented that they often go to work sick because of restrictive company policies (lack of enough paid sick days, vacation or personal days).

Stress in the Office

***A study by the National Institute of Occupational Safety and Health (NIOSH) conducted in 1975 found that secretaries had the second highest incidence of stress-related diseases among 22,000 workers in 130 occupations. The research team identified 1) rapid work-pacing, especially machine-pacing, 2) long working hours and 3) repetitive or monotonous work as the factors leading to high levels of stress among very different jobs. (Secretaries ranked second after unskilled laborers.) 17/

***Results of the Framingham Heart Study released in February 1980 show that women clerical workers developed coronary heart disease (CHD) -- clearly identified as a stress-related disease — at almost twice the rate of other women workers including housewives (previously thought to be at greater risk than working women). Furthermore the 8-year study found that women clerical workers with children and blue-collar husbands developed CHD at nearly twice the rate of all men workers. 18/ (See Figure 2.)

The researchers found that secretaries, typists and other clericals who developed CHD were more likely: (1) to have an unsupportive boss; (2) to suppress feelings of anger; and (3) to experience few job changes over a ten-year period. Drs. Haynes and Feinleib write: "These findings are consistent with observations that women clerical workers may experience several forms of occupational stress, including lack of autonomy and control over the work environment, underutilization of skills and a lack of recognition of accomplishments."

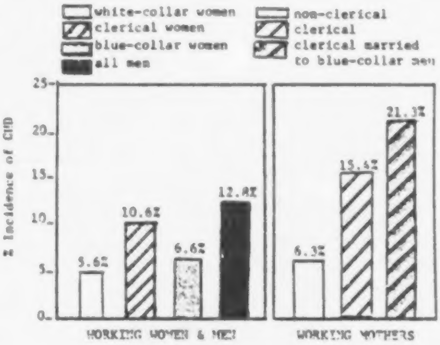


FIGURE 2: 8-Year Incidence of CHD For All Men and For Working Women Age 45 to 54 By Occupation, Marital Status and By Children. Adapted from Haynes & Feinleib, "Women, Work and Coronary Heart Disease: Prospective Findings from the Framingham Heart Study," February 1980.

White-collar includes professional & managerial
Blue-collar includes manual & service workers

More than one in five women clericals with children and married to blue-collar men developed CHD in the course of the study (21.3%). None of the participants had heart disease at the outset. The extraordinarily high rate among women clericals with blue-collar families led the researchers to conclude that "economic stress" played an important role in the health problems which the women suffered.

***The American Academy of Family Physicians found, in a study of six occupations, that two-thirds of the secretaries described their work as "usually" or "always" stressful. 19/

More employees are filing -- and winning -- Worker's Compensation claims, including women office workers 21/:

- *An older legal secretary received permanent disability payments for a "psychotic break" which occurred after she was teased incessantly by a young attorney while carrying a heavy workload at a California law firm. One day her arm went numb, she became dizzy and couldn't speak clearly.

- *A secretary at Burroughs Corporation won a $7,000 disability claim in Detroit after she became hysterical when her boss would not stop asking prying, personal questions and criticizing her for going to the bathroom too often.

- *A bookkeeper for an insurance agency won a claim in Arizona for a compensable industrial accident when she ended up in a psychiatric hospital after taking a slight overdose of sleeping pills. She had been working long hours of overtime for her employer, an expanding insurance agency.

In the Office Workers Health & Safety Survey, 72.5% of respondents reported "somewhat stressful" or "very stressful" working conditions. The sources of stress reported are shown in rank order in Table 1.

TABLE 1: Office Worker Health & Safety Survey[1]

RANK ORDER	SOURCES OF STRESS ON THE JOB	ADJUSTED FREQUENCY RESPONSE[2]
#1	Lack of promotions or raises	51.7%
#2	Low pay	49%
#3	Monotonous, repetitive work	40%
#4	No input into decision-making	35.1%
#5	Heavy workload/overtime	31.5%
#6	Supervision problems	30.6%
#7	Unclear job descriptions	30.2%
#8	Unsupportive boss	28.1%
#9	Inability or reluctance to express frustration or anger	22.8%
#10	Production quotas	22.4%
#11	Difficulty juggling home/family responsibilities	12.8%
#12	Inadequate breaks	12.6%
#13	Sexual harassment	5.6%

Notes: (1) The survey was distributed in Cleveland and Boston in the fall of 1980. Full results are presented in section 4 of this report. (2) Adjusted frequencies are based on 915 respondents answering the questions on stress (95.3% of the total 960 survey respondents).

In office work, a series of major workplace stressors (sources of stress) converge in the nation's largest single occupation.

Clerical work now represents nearly one in five members of the U.S. workforce, and accounts for more than one in three women who work.

Most often, women office workers lack organized means to improve pay, benefits or general working conditions.

Sources of Stress on the Job

The harmful effects of job stress usually result from the cumulative, combined effects of a set of job pressures and problems -- rather than a single cause of stress. A number of interrelated factors must be considered: (1) the objective conditions of the job; (2) the level of job satisfaction or dissatisfaction, potential for advancement opportunities and the ability to exercise some control over the pace and organization of work; (3) how individuals react to job characteristics (as "challenging" or "stressful"); (4) the varying effects of stress on different individuals and varying ways of dealing with stress; and (5) whether a person under stress has "social support" on and off the job.

Job stress should be examined with a "systemic" approach. Stressors in clerical work include: environmental strussors; ergonomic problems -- problems related to poor equipment, workstation and job design; socio-economic sources of stress; employer-employee relations; and the pressures of service work which involves contact with clients and the public. Whether a person is rewarded for their efforts or not, and what they can do to change conditions and eliminate stress are important factors which can make a situation better or worse, by either "moderating" or intensifying stress.

TABLE 2 illustrates the multitude of stressors common to office work. Information is drawn from a wide range of scientific sources. 22/

TABLE 2.

SOURCES OF WORK-RELATED STRESS AMONG OFFICE AND CLERICAL WORKERS

ENVIRONMENTAL	JOB DESIGN
noise, lighting	rapid work pace
skin irritants	lack of control over time & work
temperature and humidity problems	work at keyboards & VDTs
large-space "open" office	constant sitting
poor workstation and furniture design	repetitive, stereotyped tasks
inadequate ventilation	lack of adequate rest breaks
windows that won't open	heavy workload/overtime
overcrowding	underutilization of skills
safety and fire hazards	office automation
EMPLOYER/EMPLOYEE RELATIONSHIP	SOCIO-ECONOMIC FACTORS
lack of respect	low pay
non-supportive bosses	dead-end jobs
too many bosses	high incidence of job dissatisfaction
pressure for higher productivity	dual role of women workers
responsibility without authority to make decisions	lack of childcare
lack of recognition for promotions	the experience of sex, race and/or age discrimination
inability of employees to express anger	increased workload due to staff cutbacks
ineffective or non-existent grievance procedures	job insecurity

Use of VDTs, indoor air pollution and other problems in the office environment will be discussed in later sections of this report. In this section, the focus is on job design characteristics and institutional stressors.

Key Sources of Job Stress

Previous research identifies major causes of stress which affect employees in vastly differen [illegible]bs:

Heavy Workload. Too much work to do in too little time comes up again and again as one of the top sources of stress. In studies of air traffic controllers, the men in the areas of the most dense traffic were the ones who developed hypertension at a very early age, while controllers in areas of normal traffice flow showed an average incidence of the health problem.

Insufficient staffing and unreasonably high demands for "output" are frequent problems for office workers. Conflicting demands from "too many bosses" often compounds the stressfulness of a heavy workload.

> D.M. describes two successive jobs at one of the country's most prestigious universities. In her first job, she typed for several professors, with no one supervisor to intercede when deadlines conflicted. As a result, she had extreme pressure to complete work by unrealistic deadlines. Her boss was very unsupportive; he was unwilling to back her up for raises or promotions. When she was out sick, he called her at home with work-related demands. Because D.M.'s stomach problems became so severe, her doctor advised her to transfer out of the first job to avoid developing an ulcer.
>
> In her current job (as in the first) the pay is very low, while the workload is very heavy with frequent overtime expected. She often works continuously with no breaks or lunch hour. She experiences constant interruptions from professors and impatient students.
>
> D.M. suffers from insomnia, her sleep often interrupted with nightmares about not being able to meet deadlines at work. She has shoulder and neck pains from typing, photocopying and collating all day. To try to deal with the stress from the job, D.M. takes tranquilizers prescribed by her doctor, finds she overeats and has drinks almost daily after work.

Balance is very important in workload problems, as researchers point out that too little work can also cause stress. The "quality" of the workload should be considered, too. An especially bad combination is having too much work (a "quantitative overload") which holds too little interest or offers too little challenge (a "qualitative underload"). Such a combination becomes even more common with the advent of automation in lower-level office jobs. 23/

Long Working Hours. Previous studies of male workers provide evidence of a strong relationship between long working hours and stress-related disease.24/ One study found that men who worked 48 hours a week in light industry had twice the rate of death from coronary heart disease as those who did the same work for no more than 40 hours a week.

Secretaries and clericals in certain jobs cite frequent unexpected overtime, usually mandatory, to meet deadlines or handle seasonable heavy volumes of work.

> Patricia is a word processing specialist who worked for Boston Safe Deposit & Trust Co. last year. The job involved researching notes for a weekly publication. Besides skipping lunch every Thursday to meet the weekly deadline, Patricia often had to work through lunch and do overtime in the evening because the people whe worked with ignored deadline dates. In a typical week, she put in 60 hours for her $13,500 yearly salary. There was little respect for her work in the office and she lost confidence in herself. She experienced daily back, neck and eye

> strain. Three days out of five, she was totally physically exhausted by the time she got home. She couldn't sleep some nights from worrying about her job.
>
> Patricia is much happier and more confident in her new job. The bank presently has 4 people doing the job she did alone. Recently her former supervisor offered her $400.00 a week to return to Boston Safe Deposit & Trust. Her response: "NO WAY."

Exceptionally long working hours for women result from their "dual role" as homemakers and wage earners. The average working woman puts in 70 to 80 hours a week when work in the home is added to work in the paid labor force. Married men average 50 hours a week. 25/ "The modern working woman is on permanent, unpaid overtime."

Some researchers believe that overtime and heavy workload are only significant when correlated with job satisfaction. In other words, when a person is rewarded for extra time and effort, his or her health is not as likely to be adversely affected as that of someone in a dead-end job, according to the results of recent studies. 26/

Rapid Pacing and Machine-Pacing of Work are very powerful factors in stress-related symptoms. NIOSH researchers believe that rapid work pace is one of the major reasons for their finding of extremely high levels of job stress among secretarial and clerical workers. 27/

Office work has traditionally involved meeting many deadlines, making fast, frequent decisions, and carrying out quick transactions. Today, office work is being "speeded-up" as factory-based methods of time-motion study are being applied inappropriately to information-processing work.

An 8-year employee of the data-entry department of a large Cleveland utility, describes the increased pressures and health problems where she works:

> "Everything seemed just fine at work until last summer, when a company-hired management consulting firm came into our department, supposedly to study how management could work better. But instead of improving management's operation, the consultant began to carefully measure and time our production speed! We used to have to process a maximum of 4000 checks a day. Now 4000 has become the minimum -- that's one check every 6 seconds -- and the average they require is between 5 and 6,000 -- about 4 seconds per check.
>
> Now, they are treating us just like machines, expecting that everyone can do exactly the same amount every day, no matter how hard or easy checks are to process. It's hard to keep your temper from flaring when you're so tense about meeting production quotas. Someone is going to have a nervous breakdown in there someday. I just know it...
>
> Almost all of us are having eyestrain and headaches at the end of the day, and half the girls are having stomach problems, as well as back pain, neck pain, aching shoulders, arms and wrists. Two of the women have been told by their doctors that they have pre-ulcerous conditions. I know a lot of people haven't been sleeping well, which means we get sick a lot more easily and have an even harder time keeping up with the pace of work."

Recent years have seen an increase in the use of automatic call distributors, prompters, production quotas and computerized monitoring of clerical work. Management introduces these devices in efforts to "increase productivity" by taking control over the speed of work away from the office workers themselves. But research is beginning to show that performace often declines along with job satisfaction when control over work pace is transferred from people to machines or computers. In studies of machine-paced vs. self-paced work, error rates increase from 40% to 400%. 28/

Monotonous/Repetitive Work. Studies find the highest rates of total fatigue or exhaustion associated with the highest reports of monotony on the job. Monotonous work which requires close attention to detail but holds little interest for the employee is particularly stressful. Doing the same stereotyped motion all day causes muscular fatigue as well as job dissatisfaction. Performing the same set of routines without the chance to learn new skills can lead to boredom , frustration and decline in self-esteem. 29/

> "I've been doing this job for 10 years, and I've been tired for 10 years," says a 30-year-old data entry operator. "It's the monotony that does it. I'd like to know what it feels like not to be tired."
>
> A woman who worked as a clerk-typist in a large San Francisco law firm recalls: "In that law office job, 'cause I hated it so much and it was so boring, I just felt like I was the living dead. I had no attitude. It was like being in a coma for two years." 30/

Service Work. There are special pressures in jobs which involve responsibility for people (rather than things), notably in the health and medical industries and in social services employment.31/

Customer service representatives for banks, utilities, public agencies and insurance companies are in constant contact with clients, frequently handling complaints. Women office workers rarely have the authority to make decisions which could solve the problem. Bureaucratic procedures and rigid production quotas are often imposed.

> In November, 1979, the new computer system of a Cleveland insurer proved a disaster, making it impossible to process many transactions. All vacations were suspended and employees had to work overtime for several months to handle increased calls from worried and angry policy holders. Today, the company is still millions of dollars behind in claims payments, the employees are still working frantically, and the computer problems remain unsolved.
>
> Janet, a customer service representative who answers the phone all day, says: "You want to help the people calling in, but there's nothing you can do. The management won't even tell us what's going on. So we can't tell customers who are upset anything to calm them down. They scream at us, they might call you every name in the book, but if you even pause for a second to recover between calls, the management is on your back -- 'Answer the next phone call, etc...' They (the company management) use automatic call distributors for everything. If you go to the ladies' room, it's 'Where is she?' 'Why aren't you at your desk?' 'How many calls have you handled?'"

Discrimination as an "Institutional Stressor." The cumulative effect of experiencing discrimination on the basis of sex, race, age or combinations of the three, amounts to chronic stress for many women office workers. Such discrimination manifests itself on a personal level, on an institutional basis -- in longterm denial of promotions and training, and in crisis events such as being fired, threatened with dismissal or urged to take early retirement.

> L. is 55, has raised six children single-handedly, and still supports one. She is a senior sales coordinator for a manufacturing firm in Cleveland, a job which she does meticulously. "It's such a sexist company," she says. "Work is a constant putdown. The men say things like, 'We need fuss-budgets like you around -- I mean old maids.' I can hardly tolerate the men's language, or their physical advances towards the younger women. I have to defend myself all day long. And I look out for a younger co-worker who gets very upset -- but she never talks back to them, so I end up fighting her battles as well as mine."

> Martha is 43, the sole supporter of six children. She works on the twilight shift from 4:15 to 11:15 p.m. in a branch office of a major New England bank, with one 10-minute break and one-half hour for supper. She has worked for the bank for 10 of the last 12 years, but has only been advanced two job grades in this time. Her supervisor still assigns tasks to her which should only be given to employees in grade 8, while she is now a grade 10. To add insult to injury, a younger employee who is a favorite of one of the supervisors was just promoted over a woman with twenty years of service. Now, morale is very low, at least one worker is leaving and other longterm employees are looking for different jobs. Martha is very angry about the unfairness of the situation. She has an ulcer and has 'heartburn' once or twice each month, finds herself smoking more than she wants to, takes two Tylenol every night and sometimes takes a tranquilizer to calm down and fall asleep.

A black insurance worker in Cleveland observes: "As women and blacks get involved in more areas, the employers seem to devalue those areas. They don't heighten the salaries for those areas, and there's less and less status, so they are still working against us while we're supposedly trying to make some progress." On a personal level, race discrimination at work is always degrading and often heartbreaking, as when a boss refers to a black woman as "Magnolia" rather than by name, or co-workers exclude her from social events in an office. "My children want to know 'why are you upset' or 'how come nobody likes you' or 'how come you always have to eat lunch by yourself?'" says a minority bank employee. "There have been incidents where they'll say, 'Well, Mom, do you want me to come down and have lunch with you?'" 32/

Lack of Recognition/Lack of Respect. Women office workers suffer from a lack of recognition for their contribution to the overall effort, as well as from low pay and unfair treatment. Clerical workers frequently complain that they are "treated like children" or "treated like machines," and rarely granted their due measure of respect.

> "I deal with top university administrators who always seem to need everything immediately. Everthing is on a 'rush' basis, and they expect perfection as well. When I respond to their

> demands with a perfect and quick product, they expect it all the time, and don't even think to express any appreciation for a job well done," explains a campus staff assistant. Furthermore, she adds: "The so-called 'support staff' is perceived by the 'Staff' as being 'different'. There are unwritten protocols of behavior prohibiting 'Staff' from socializing with 'support staff' on lunch hours."
>
> Another woman writes: "Office workers are routinely made to feel that they are non-persons in the company structure. Memos are addressed to 'Attorneys, Para-Legals, & Legal Personnel", never to Secretaries. The only event we are invited to is the Christmas party."

Unsupportive bosses or supervision problems often go hand in hand with inability or reluctance to express anger and lack of input into decision-making. Comments from Working Women's survey and follow-up interviews help to illustrate these interconnected causes of job stress. More often than not, women report that there is no means to resolve workplace problems -- grievance procedures are described as "ineffective" or "arbitrary". Among women who have raised problems with the management, an alarming number found they were threatened into "keeping quiet" -- told that their "attitude" might have a negative effect on their next performance or salary review or "encouraged" to find employment elsewhere.

> Linda has worked for a very large brokerage firm for many years, for the past three years in Boston. She is the secretary to the office manager and when he is out of the office, it is assumed that she will take over. Her boss is very unsupportive. When she asks to see her job description, he says things like, "I'll get on that" but he never does. Linda feels she should get a raise because she's responsible for the office running smoothly when he is away. But she's been told by her manager "If you don't like it here, leave" in just so many words. In fact, the company makes it very clear that there are many applicants for her type of job, and she was told that they could probably fill her vacancy (if she left) that same day!
>
> R. is 50 years old and has worked for a very large law firm in Boston for the last five years. She feels the main contributor to stress on her job is the lack of any way to air grievances, expecially concerning unfair salary reviews:
>
> "There are no job descriptions and no grade levels... There seem to be no guidelines for salaries -- new people are hired for salaries greater than those with seniority. I have a part-time assistant who earns more than I do!" She continues, "Raises are not handled confidentially; lawyers who have little interaction with an office worker save being located nearby will be asked to give their recommendation for her raise and will therefore have access to her personnel file. Even though the firm's own policy review committee found this procedure to be unacceptable, it's still how it's done... In one case, the letters from a worker's supervisors were excellent, but she was given a lower raise than most due to a 'poor attitude' that was perceived only by Personnel. In short,... your salary depends upon who is asked to provide

your recommendation — and your recommendation may or may not be shared with you, depending on the wishes of the person writing it -- rather than on your performance..."

About two years ago, [illegible]0 secretaries met in the firm's library to make plans to air some of their grievances. Immediately, a memo from the management went out denying them the right to use company space for such a meeting. The memo effectively stopped them but, according to R., interest is stirring again.

Lack of Job Security. With no grievance procedure and no union contract, office workers can be laid off, disciplined or fired at the whim of their boss. This pressure increases in mid-lide when age discrimination arises and finding a new job is more difficult. The U.S. Department of Labor notes that job tenure -- years on the same job -- is declining due to the rapid introduction of new technology and the shift towards services employment. In the NIOSH study of Blue Shield's San Francisco offices, half of the clerical employees feared that their jobs would be eliminated within the next five years as a result of automation. 33/

Combined Effects of Stress

Sources of stress interact with one another. The combined impact of a set of problems can lead to strain, whereas any one of the problems might not be stressful by itself. 34/ Potential for job satisfaction, interesting work, good social and work relations in the office, and the ability to decide the speed and methods of work are "mediators" of job stress, factors which "moderate" stressful demands by making the effort worthwhile. When such rewards or support systems are absent, the health risks of stress are greatest.

Job Satisfaction is very important to good health and positive mental well-being. One study found that men who lived longest were those who were the most satisfied during their working life.35/ Job dissatisfaction is now considered by some scientists to be as much of a "risk factor" in heart disease as cigarette smoking or a high cholesterol diet. 36/ Women workers are twice as likely to be dissatisfied with their jobs as men, according to a major study conducted in 1971. The main reason women give is the gap between their expectations and the reality of dead-end jobs.37/

Underutilization of skills is a major problem for working women. A woman office worker's job status often does not reflect her real job responsibilities, years of experience, or years of education. In 1973, about one out of six women college graduates was in a relatively low-paid clerical position.38/ Again and again, older and more experienced women tell of being passed over for promotions, often by young men they have trained.

Being passed over for a promotion is "one of the most devastating events that can occur" to a young or middle-aged professional's career.39 / In the Framingham Study, job immobility -- few job changes over a ten-year period -- was one of three predictors of heart disease among clerical women.

According to Working Women's survey, lack of promotions is the number one source of stress. Two-thirds of the survey respondents said that job training and advancement opportunities need improvement where they work. The ability to keep learning new skills and to have challenge and pride in one's work, is extremely important in reducing stress. 40/

> A university employee, L. worked as a department secretary for several professors for 7 years. "I used to get splitting headaches and have trouble sleeping at least a couple times a week. I was tense all the time, frustrated and often angry," she says. Finally, L. was promoted to head a department in administrative services. "I waited two years for this promotion. Since I moved up, I've noticed that a lot of the problems seem to have fallen away."
>
> For the last 15 years, S. has worked for a small family-owned pipe plant. She's worked her way up to coordinator of export sales, a position with a lot of responsibility which she really enjoys. "It's very challenging... There's no routine and I have complete control over my time," she says proudly. The situation seems ideal until she tells you about tne open-heart surgery she had a year ago. "I am positive that my heart condition is a result of stress on the job," she states firmly. And in fact, two doctors urged her to look for other work, and one even withheld her medicine briefly in an effort to force her to change her place of employment.
>
> S.'s case shows that finding personal satisfaction in a job is not enough --. a person needs recognition, too, and the chance to keep advancing. All the women in the office are in clerical or -- at best -- "coordinator" positions, while all the men are in sales or management. Eight years ago, the company brought a man in from the outside to be manager of the export department, rather than give the job to S. Later they admitted to her that this was a mistake, and that she could have done the job as well as he. The export manager retired last September. And still, the company refuses to promote S. to manager, even though she is running the department. Tensions are running high as she keeps up the pressure for the promotion, and they continue to resist the change.
>
> Although over 50, S. had no history of health problems save once five years ago when she had to take time out for severe arthritis. The last five years have been a real battle, with clear implications for her health. "I can feel the bad feelings coming on again," she says concerning her health since the heart surgery. "I'm getting all uptight again, and I'm coming home exhausted." Her doctors' only advice is to get out of the job. But S. loves her work and refuses to let the men in management get the best of her.

Demands and Control on the Job. Managers have long been perceived as the people under the most stress. A major study comparing job characteristics with national health data by job title lays this belief to rest.

Professor Robert Karasek of Columbia examined different "men's" jobs by levels of job demands compared with levels of control on the job. "Control" is a measure which includes the degree of decision-making authority at work and ability to use one's skills. Relative job insecurity was added, and finally national health data used to predict risk of heart disease was calculated in by occupation. The study finds that assembly line workers -- under high pressure for "output" but with little control over their work -- are in greatest danger of heart ailments, not managers or lawyers. Men in "active" jobs -- jobs with both high demands and high control on the job do not typically experience as much strain as workers in jobs with high demands but low control -- little influence on decisions, few ways to use skills or gain new skills, and less job security. 41/

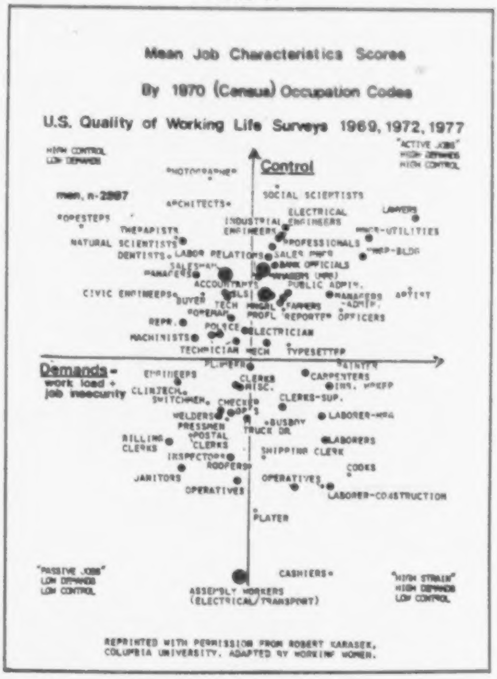
Figure 3. charts men's jobs according to levels of job demands and control, plus relative job insecurity.

"Active jobs" -- with high demands and high control -- are shown in the upper right hand corner or "quadrant", eg. managers and lawyers.

The "high strain" quadrant -- jobs with high demands but low control -- is in the lower right hand corner. The highest levels of job strain are predicted for jobs appearing in this area, for example, assembly line workers, operatives and laborers.

(The size of the dots generally indicates the relatively large or small number of people in a given job, although sizes have been enlarged for the sake of visibility.)

FIGURE 3.



Mean Job Characteristics Scores

By 1970 (Census) Occupation Codes

U.S. Quality of Working Life Surveys 1969, 1972, 1977

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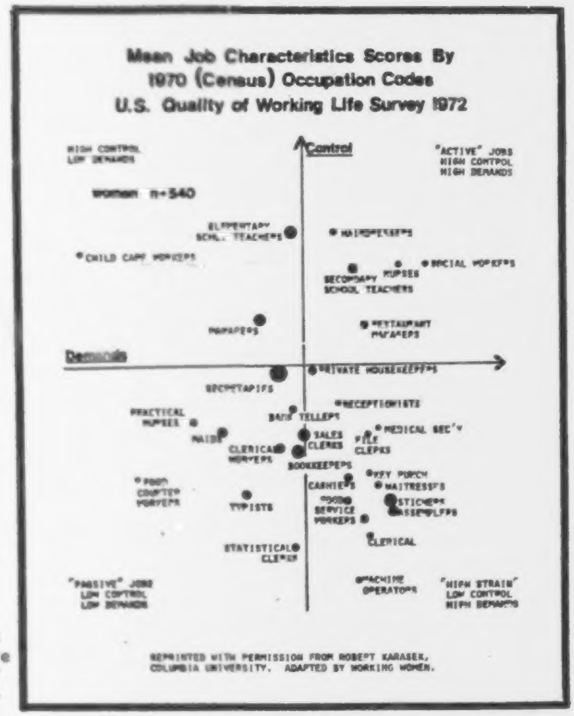
Figure 4. on the following page shows the positions for "women's" occupations by levels of job demands and control. Please note that these are preliminary figures only (for women workers).

Karasek's research also undermines a commonly held belief that "stress-prone individuals bring problems on themselves because of their lifestyle and personal habits." In the study of job demands, job control and CHD risks, the difference in heart disease rate between assembly workers and managers is four times the standard for statistical significance, a much greater gap than can be accounted for by difference in personal circumstances. The findings clearly implicate working conditions in stress and disease. Karasek notes that it's more likely that "the main effects of individual differences are in the effects of stress -- whether a person gets physically sick, gets insomnia, an ulcer or suffers psychological strain. 'Everybody gets some stress.'"

One of the goals of the research is to figure out methods of job redesign which will reduce strain. Toward this goal, Karasek writes:

> "Possibly the most important implication of this study is that it may be possible to improve job-related mental health without sacrificing productivity...for the lowest status jobs the reduction of strain associated with increases in decision latitude (control) is substantial."

FIGURE 4.



Mean Job Characteristics Scores By
1970 (Census) Occupation Codes
U.S. Quality of Working Life Survey 1972

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Figure 4. shows results of a preliminary analysis of "women's" jobs by the job characteristics of demands and control only. Relative job insecurity has not been included. Health data will be calculated into each job in research currently underway.

Jobs combining the most intense job pressures with the lowest levels of control over work include telephone operators, bookkeepers, and file clerks, with secretaries and typists very close to the "high strain" quadrant.

Karasek observes that: "...women's decision latitude on the job is much lower than that for men... Furthermore, while men and women report roughly equal workload demands, the combination of high demands with low control — the high strain job — is much more common for women (in men the common combination is high demands with high control). Since these jobs are associated with high levels of psychological stress, this occupational concentration may account for the higher observed rates of mental strain among working women, otherwise often implicitly attributed to 'female frailty' or 'excitability'." (Emphasis added.)

Economic Stress

Today two-thirds of all married working women have husbands who earned $10,000 or less in 1979. Among minority working wives, four-fifths are married to men earning $10,000 or less, according to the Bureau of Labor Statistics. In addition, about one in seven women in the labor force is the head of her household.

The majority of women with children under 18 work today. And for all women with children under 6 years old, 45.5% are in the workforce — 67% among divorced mothers with small children. Author Caroline Bird points out: "Instead of keeping women at home, children of the 1970s were the expense that drove women to earn, for wives with children at home were more apt to be earning than women in general."42/

In 1981, the Bureau of Labor Statistics calculates a low-income budget for a family of four at $12,585; at $11,000 a family of four qualifies for food stamps. And the poverty line in 1981 is $8,450. In 1979, almost 30% of fulltime women clericals who worked year-round earned less than $7,800 and 81.7% earned less than $13,000, according to the Department of Labor.

The lack of accomodation by the business world to the working women's family responsibilities is a further source of stress. Women very often use vacation time to care for sick children. Many child care arrangements do not mesh well with unexpected overtime. Few employers provide support for child care (whose cost averages $50 per week per child). Flexitime, now possible for 20% of the total workforce, is increasing but still available to only a tiny percentage of clerical (or production) workers. Job sharing and stable part-time employment with fair benefits are still the exception rather than the rule. A study of part time women workers found that stress levels were lowest among married women part-timers with husbands present and children, and highest among women heads of families with part time jobs.

A recent national survey on mental well-being found a vast difference between women and men. Almost 80% of the men polled said they were in a state of "positive well-being". But only 67% of the women surveyed and barely one in three minority women described their general state of mind as positive. More than half of black women participants reported moderate to severe levels of stress, tension and anxiety, about double the rate for all women. The same study found no difference between men and women at the upper end of the income scale. The conclusion: the differences are not sex-based, but reflect socio-economic status. 43/

Recognizing and Reducing Stress.

If the causes of office worker stress can be categorized as environmental, job design, employer/employee relations and socio-economic problems, an effective program for stress reduction for office workers will seek to alter these factors. Occupational mobility, a say over working conditions, economic security and relief from the most severe environmental and ergonomic stressors are important to office worker wellbeing and good mental health.

Some employer-sponsored approaches to stress, often going by the name of "stress management," have as their primary goal the protection of productivity. As a result, they may fail to protect the worker. This approach may build one's "tolerance" to stressful conditions, but provides no relief from the sources of stress. To protect the health of the workforce requires strategies to eliminate the causes.

At the same time, eradicating the sources of job stress for office workers is a longterm task. A complementary balance must be struck between moderating the effects of stress on the worker and eliminating stressors from the workplace.

Moderating Stress can be defined as reducing adverse health consequences or offsetting negative conditions with positive conditions or activities. The three keys to moderating job stress are increasing input into decision-making, increasing job satisfaction and increasing social support. 44/

Individual methods. Better diet, more exercise and improvements in lifestyle are certainly important to good health. But these are probably not adequate or realistic remedies for millions of workers at the most risk from job stress. One writer speculates that if toxic fumes and noise, excessive supervision and harassment, rigid work rules and speedups or job insecurity are at issue, "industrial psychologists may not be able to persuade the average ... worker that an hour of jogging a day" is the solution to workplace hazards, even though it's surely a good thing to do. 45/

Assertiveness training, by teaching individuals to voice their views and negotiate with peers and authority figures,can be an effective way to promote constructive approaches to job problems including stress.

Strategies for Reducing Stress. Because workplaces and individuals vary, it's important to identify the sources of stress at play in a particular job, department or company.* However, some common strategies for reducing job stress for office workers can be described: 46/

- Environmental. Reduce noise, improve ventilation and lighting, remove toxic chemicals from use, provide a lounge area for rest and social interaction.
- Job Design. Redesign jobs to allow more variety, provide adequate rest periods and job rotation, opportunities to learn new skills, increased job decision latitude, increased control over workload and pace, realistic production standards.
- Employer/employee relations. Change the style of supervision and train supervisors in human relations, provide respect and recognition, effective grievance procedures, implement fair and non-discriminatory promotion and salary policies, increase workers' participation in decision-making.
- Socio-Economic. Include mental health counselling coverage in benefit package,accommodation to the needs of the working family - such as flextime and child care, support for continuing education, access to advancement and training opportunities, improve pay and benefits, increase job security.

Methods of stress reduction may require organizational representation, and/or assistance in organizational efforts, among clericals. Because most office workers generally do not have unions, less formal support groups are a necessary route to reducing stress. Assertiveness training, organizing skills, assistance in approaching and "negotiating" with management are all skills which office workers will need to make changes in their work environment. Many unions have formed special committees or task forces to address stress as part of their health and safety activity.

In summary, the role of chronic job stress in physical illness and psychological strain is very complex. Physical and emotional responses to stress are not neatly separable but build on one another. Although it is not possible to say exactly how particular stressors on the job lead to particular health problems, there is enough evidence to guide us in figuring out strategies to reduce and eliminate stress from women office workers' jobs. The research findings that we already have make it clear that steps to eliminate stress in the office need to be taken now, even while more research is underway.

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* The Office Workers Stress Test, available from WORKING WOMEN, is designed to help recognize and evaluate stress.

CHAPTER III: VIDEO DISPLAY TERMINALS

By 1985, more than ten million people will use video-display-terminals (VDTs) at work. Observers estimate that a new VDT is installed every thirteen minutes, and experts predict that 10% of all workplaces will have at least one display unit in the near future. 1/ They are already used extensively in banks, insurance companies, law firms--in any industry where large secretarial pools are employed.

In 1979-80, the NIOSH conducted a study of video display terminal operators at the request of a coalition of labor unions. Five worksites were examined, including newspaper offices and the clerical departments of Blue Shield in San Francisco. Eighty to ninety percent of the clerical VDT operators experienced eye strain or muscle strain. High levels of anxiety, depression and fatigue were reported by VDT users at all of the worksites. 2/

The NIOSH research team found that VDT operators in strictly clerical type operations showed higher stress ratings than any group of workers NIOSH has ever studied including air traffic controllers.

Clerical workers using VDTs were compared with a "control group" consisting of office clericals doing similar work but with pen and paper, conventional typewriters, and with professionals using terminals--mainly newspaper reporters and editors. All of the clericals reported high levels of anxiety, confusion, depression and fatigue, as well as very high rates of physical health problems. The "VDT clericals" experienced the highest levels of job stress, while the "VDT professionals" had reported the lowest stress levels with the "control clericals" in the middle. A vivid description of the differences in working conditions for the clericals and professionals follows:

> "When the job features of the various groups are examined we see that the clerical VDT operators held jobs involving rigid work procedures with high production standards, constant pressure for performance, very little operator control over job tasks, and little identification with and satisfaction from the end-product of their work activity. In contrast to the clerical VDT operators, the professionals using VDTs held jobs that allowed for flexibility, control over job tasks, utilization of their education and a great deal of satisfaction and pride in their end-product. While both jobs had tight deadline requirements, the professional operators had a great deal of control over how these would be met. In their case, the VDT was a tool that could be used for enhancing their end-product, while for the clerical VDT operators, the VDT was part of a new technology that took more and more meaning out of their work. It's not surprising that the professionals using VDTs did not report levels of job stress as high as the clerical VDT operators... This suggests that the use of the VDT is not the only factor contributing to operator stress levels and health complaints, but that job content also makes a contribution."

Health Symptoms Related to VDT Use

Conclusive information on the long-term effects of VDT use will take years to obtain and analyze, but the short-term effects are already well documented even though the causal mechanisms are not yet understood: eye-strain; headache; short-term loss of visual acuity and changes in color perception; back, neck and shoulder pain; fatigue; stomach aches and vomiting. 3/

Health symptoms may result from problems in machine, workstation, office environment or job design, or a combination of these. Eyestrain is often worse for employees doing "terminal intensive" work--looking at an "interactive" terminal all day or looking back and forth between hard copy and a screen continuously. Muscular strain in the neck, shoulder, back, hands and wrists is often worse for data entry workers who do not look at the screen as often, but must adopt awkward set postures to work at top speed for hours on end.

Eyestrain, postural problems and musculo-skeletal problems are aggravated by poor lighting, uncomfortable chairs, mismatched chair, desk and keyboard heights, lack of workspace, humidity, temperature and air quality problems, bright, shiny surrounding walls and surfaces which maximize glare, and a general lack of adjustability afforded the office worker(s) using VDTs. When an office worker's chair, keyboard and screen, and lighting are all unadjustable, it is she who must do all the adjusting. The result: a set of problems which compounds the stressfulness of the job and threatens one's health.

> Kathy and Susan work as reservationists for a travel agency. They have both worked there for a year and a half in jobs paying less than $8,000 a year. They spend their full day at VDTs making reservations, looking back and forth between paper and the screen. The terminals have brown screens with orange letters. According to Kathy, "There is terrible glare off the screens because the lighting is so bad. The machines sit on white formica tables which makes the glare even worse. We have headaches at the end of every day..."
>
> Both women wear glasses, and say that working at the terminals has caused their eyesight to deteriorate.
>
> Another woman, B. spends about half the day at the display screen and has been on the job several months. She says her vision has worsened, becoming more myopic, due to continual focusing on the screen. A co-worker went from perfect vision to nearsightedness and had to get glasses for the first time. All four of the women report upper back and neck pain from craning to look into the screen. B. says that when she works at the screen for more than four hours, she comes home feeling more drained of energy than usual.
>
> They feel that something must be done about the glare and the lack of adequate rest breaks.
>
> "The company only allows two ten minute breaks, and thirty minutes for lunch. But what's worse is that you cannot take these breaks when you need them. They must be taken at a time specified by management, and if you're on the phone taking a reservation when the time comes, you lose your break!"

Machine Problems. Although improved equipment is available, there are still a great many low quality models on the market and in use. Frequent problems with machine design include: "nauseating colors" especially fluourescent green; "low resolution" images which lack contrast from background color or generally lack clarity; characters that are too small, too faint or otherwise difficult to read; overly flickering images due to an inadequate "refresh rate" in cheap machines or inadequate maintenance and replacement of cathode ray tubes; shiny keys and casings designed to look "space-like" without regard for the excess glare they cause the user; keyboards attached to screens which can't be adjusted for viewing distance or angle. Since anti-reflection filters are optional components for purchase, they are too often overlooked in the name of office economy.

Lighting problems are probably the biggest complaints from display screen users. Work at VDTs is very demanding visually, much more so than reading newsprint or a book for the same amount of time. One study found that under laboratory conditions, 50% of the subjects reported a burning sensation in the eyes, 33% reported headaches, and 25% experienced flickering vision. The study found that the operators experienced a 50% deterioration in visual clarity, especially severe after four hours of uninterrupted use. 4/

The problems caused by VDT work are increased by lighting conditions designed for traditional office work, according to Swedish scientist Dr. Olav Østberg. Østberg estimates that typical office lighting will cause discomfort for about half of all VDT users. Office workers often find that they need to wear tinted glasses to reduce glare. A combination of more subdued overhead lighting and adjustable "spot-lighting" for copy or "input" is helpful, but not always readily provided.

> Priscilla is a word processing specialist. She used to work for a financial corporation, "stuck in the corner" of a poorly lit, noisy area. The only lighting was overhead, fluorescent and unadjustable. She requested a desk lamp and waited for two months. When nothing happened, she refused to work until the company got her the lamp. She stayed out of work for two days, finally got the lamp, but then she had to work overtime to make up the time she lost. Priscilla's eyesight worsened. She had to get stronger glasses due to continuous work at the word processor, under poor lighting conditions. When she brought this to management's attention, they admitted it was work related but refused to pay for her eye exam or new lenses. Finally, she left for a job with better pay, fewer hours, and less stress.

Workstation Design. As much flexibility as possible should be provided. Work spaces should not be overcrowded so that build-ups of heat, noise or stuffy air are avoided. Chairs and desks should be adjustable since office workers themselves come in all different heights.

> A. works in the resources department of a large university. She works on a Wang word processor about 3 or 4 hours per day, and does a variety of work at the terminal, entering and editing documents for four writers. Overall, she feels she enjoys working with the word processor as an aid in her job. However, she has several complaints: 1) Her neck and shoulders often ache. The screen is attached to the keyboard and she is tall. Even though the keyboard height is comfortable, she has to hunch down to see the screen. On rare occasions when she has to type all day, her body aches all over. 2) A. describes the lighting--two fluorescent lights directly overhead--as "terrible." She faces a white wall, which increases the glare. She has permission to correct the lighting problems, but must spend her own time and money to arrange for changes.

Office Environment. Altogether, office environments reflect too little attention to the comfort of the office workers who must sit in them all day. Appearance and fancy new equipment is unfortunately more important to some managers than their employees' state of health.

> Three women who work for a small accounting firm at a prestigious downtown location comment on the high turnover rate in their office:

> "I've been there almost a year, and I've got seniority among the secretaries," Emily says. "It's the strain--everything must be done under the deadline, it always absolutely has to be done by 9:00 the next morning. We end up rushing around like crazy to make up for their delays in getting the job done so it can be typed. We are forever getting in early and there's staying late in order to use the word processor while no one else is waiting for it. We're just extensions of those dumb machines."
>
> Her co-worker agrees, and adds, "You know, when the boss brings new clients through the office to show them around, he'll point right to me working at the word processor and say, 'Here we have our wonderful new LEXITRON' and then move right on. He doesn't bother to introduce me--just the machine!"
>
> All three women experience almost daily headaches, nervous stomachs and shaky hands. They're upset that another one of the secretaries who has high blood pressure, was recently sent to the hospital for tests. Their employers don't seem to care: "The place looks gorgeous, and that's where the management's priorities lie. They're not really as interested in efficiency as they are in using people up and pushing them out the back door."

When improvements are made, office employees who will be using the new equipment should be involved in choice of machines and redesign of their work areas. A VDT operator who is a member of The Newspaper Guild says:

> "I work at a terminal all day. When the union pushed the newspaper company where I work, they improved the colors and lighting and all that for the fulltime operators. Now they have a new set-up called "the open office". There are dark blue panels six feet high around all the operators. In many cases, we don't see another person all day except for a ten-minute break and lunch time. All we see is the walls around us and sometimes the supervisor. The isolation is terrible."

"'Comfort' is the best guide to follow, and a high degree of flexibility," advises Tobi Berman of the New York Committee for Occupational Safety and Health (NYCOSH). "People need to be involved in redesigning the work area to make sure it is still pleasant and comfortable for them after changes are made. There's a need for a high degree of adjustability--chairs that can be adjusted with an allen wrench, keyboards that are detachable. But in many cases what we see is that the desk is so crowded or the workspace so small that the keyboard or screen can't possibly be moved without falling off the desk. It doesn't solve anything if the keyboard is detached but you can't adjust the distance because you don't have any room."

Visual Strain.

A recent study in Vienna found that clarity of visual focus did not return to normal for more than 16 minutes after four hours of work at a display screen, even with a 15 minute break. The Viennese government therefore proposed a limit of four hours work at a screen per day with a 15 minute break after two hours. 5/ The vision of terminal operators undergoes short-term changes described as "minor" by the U.S. NIOSH. But the agency expresses concern that these temporary changes may indicate "the potential for chronic effects given longterm CRT use." 6/ An industrial hygienist warns that VDTs "exaggerate the deficiencies in vision or any defects in the eyes".

> Anna works for a non-profit technology research center as an all-around secretary. A year and a half ago, she worked briefly in a fulltime word-processing position: "By the end of three months, working at the word processor, I developed a very frightening eye syndrome. I never had eye problems before and I've never even worn glasses. But I found that when I went from a lighten room into a dark room my eyes could not adjust--it took a full minute. I went to an Eye Clinic. The doctor said my eyes were generally fine, but they were being strained in a very bad way by my work at the machine. He advised me that if I wanted to continue in that job, I would need to take a 10 minute break every 20 minutes and focus on a faraway point. He warned me that if I couldn't do this, I had better quit or my eyes would continue to deteriorate. When I told my supervisor what the doctor said, she said 'Do whatever you want, but just get the work done!' I knew there was no way I could keep up if I took the breaks the doctor advised, so I quit after 4 months. My eyes have returned to normal, and I don't have any vision problems in my current job."

Fear that display screen viewing may cause permanent eye damage stems in part from an incident at the N.Y.Times in 1977 when two young male employees developed cataracts after working continuously at terminals (see section on low level radiation).

Office workers who wear contact lenses have even more difficulties with itching and burning eyes, especially if their offices are also too hot, too dry or smoky. And wearers of bifocals also have special problems, they must adopt extreme postures to view the screen.

"The computer is the Ultimate Unsupportive Boss."

The introduction of VDTs and other automated equipment intensifies the pace of office work in the name of productivity. Monotony and boredom increase. Operators complain of being "constantly watched" by the computer. Fear of job loss through automation is an added cause of stress. Unless the effects of computer-based systems on people are considered, NIOSH warns, such technology will become "a source of misery instead of a helpful tool." 7/

A comparative study of general clerical workers and VDT typists found that the latter experienced extreme fatigue, alienation, monotony and lack of challenge in their jobs at twice the rates of traditional clerical workers. Symptoms of stress and increasing job dissatisfaction were most prevalent among "computer-controlled" typists paid according to piecework, and "de-qualified" office workers, who were transferred from more varied clerical jobs into fulltime VDT work. 8/

> When Rose reentered the workforce last year, her excellent typing skills quickly landed her a job with a downtown Cleveland publishing company -- as one of 12 CRT operators working in a small crowded room. She found office work had changed a great deal during her years away from the workforce. "The chairs were good, expensive chairs, and the machines themselves were adjustable, too. But I have never been confined to one place doing key entry at such a pace." She explains, "The computer at one end of the room keeps track of how

many key strokes per minute you do. The more key strokes, the more money you might get. At the end of the day the figures were posted. You look at your speed, you look at everyone else, and you say, 'Tomorrow I'm going to do better.' They get you thinking just like they want to, you're really pushing hard."

"I was often totally disoriented during the first two months. ...One day --I'm not just telling you this to be dramatic -- I was sitting there at the terminal, entering data, reading from the screen, and I suddenly thought I was having a terrible nightmare. I didn't know where I was. It took all the discipline I had to sit there quietly, until the whole thing passed. I knew something was wrong and I was frightened. But I didn't understand what happened to me until I read about office health and safety in Cleveland Women Working's newsletter. As I understand more, now I feel like I can do something about it."

Rose changed jobs, and now works in a less hectic, conventional office. The strain of extremely fast-paced and contolled work at display screens does not only affect employees who once did traditional office work. Rose describes a co-worker at the publishing company: "One girl who is also a CRT operator came to the company right after high school. She's been running a CRT for close to ten years, and she's as fast as the wind. But it's really affected her personality. I used to wonder if something was wrong - she had no exuberance. Once she said to me, "Rose, as soon as I sit down at that machine in the morning I feel like I'm going to cry."

Low-level Radiation Emissions.

The original health concerns of workers on video display terminals had to do with the issue of radiation. Early NIOSH studies looked at the cataractogenic potential of VDT's, finding that radiation emissions by VDT's were below federal threshold standards. 9/

A grievance filed by the Newspaper Guild prompted a 1977 study by NIOSH of the potential radiation dangers of VDT's. Two newspaper employees who had worked continuously on VDT's developed bilateral, posterior cataracts (the type caused by radiant energy exposure). Most regions of the electromagnetic spectrum have been implicated as being cataractogenic. 10/ Although NIOSH found that all categories of radiation emission by VDT's were below threshold standards, the etiology of the employees' cataracts remained undetermined. The type of cataract observed has only four known causes; neither man had any medical history pointing to the other three causes. 11/

Many employees and labor officials fear that long-term low-level radiation dangers from VDT's will be proven 15 or 20 years from now. One Newspaper Guild official told Working Women: "This whole thing may end up like Three-Mile Island. We won't know the damage for another 10 or 20 years." The Newspaper Guild and Mt. Sinai School of Medicine have launched a long-range study of the health effects of VDTs which "should begin to provide a definitive answer as to whether VDTs produce cataracts or other damage to the eyes as well as answer persistent questions about other possible effects of radiation..." 12/

Manufacturers could use substitute technologies (which they already have developed) to remove CRT-based display screens from the workplace, eliminate this source of concern and avert potential health hazards. 13/

An excellent readable guide to proper lighting standards, workstation design, and criteria of high-quality equipment is available from the New York Committee for Occupational Safety and Health, called Health Protection for Operators of VDTs/CRTs. Important points about machine and workstation design include:

- Screens should be detached from keyboards so they are adjustable.
- Screens, keyboards, and room decor should be in mat, subdued colors to reduce glare; conventional office lighting should be redesigned.
- Look for "high resolution" screens, proper size, color and clarity of screen characters.
- Screens should allow individual operators to adjust angle, brightness and focus for viewing comfort.
- Too often, devices which reduce glare and/or noise are optional -- make sure they are purchased.
- Regular maintenance and repair are essential.

Only high quality equipment should be used, and flexibility should be built into programming and systems design. Automation in the office has the potential to reduce rather than increase stress if the following job design principles are followed:

- New technology should mean you use more skills in your work, not fewer and that promotional opportunities are increased, not reduced.
- New office technology should mean more control over the pace and organization of work, not less control.
- Increased productivity should be compensated by increased pay, more breaktime, and/or a reduction in weekly hours without a reduction in pay.

The risks associated with VDTs can be reduced while further research is in progress. Improved machines are already available for purchase. A writer for a management research firm notes that protections against operator discomfort "are to a great extent within the control of the office manager." 14/

Adequate rest periods and job rotation are the key to protecting the health and well-being of video-display terminal operators. The NIOSH recommends a 15 -minute break per hour of visually intensive work and 15 minutes per two hours of continuous work at a VDT to reduce eyestrain and stress. In other countries, limits of one and a half hours continuous VDT work and/or four hours per day have been recommended or mandated. 15/

Ms. GREGORY. In reviewing recent research findings on productivity, job stress, and trends in office automation, I will show how rationalization of work and computer-based work performance monitoring have negative effects on productivity as well as officeworkers' job fulfillment.

Increased effectiveness and productivity are common public goals. We often hear that "some sacrifices are necessary in the name of progress." There are substantial problems in accepting these premises point blank.

First of all, we believe that social criteria must be included in any meaningful concept of progress in relation to new technology. These include availability of employment, use of skills, ability to earn a decent living wage, the right to meaningful training, and chances for advancement on the job.

The International Aerospace and Machinists Union, in conjunction with scientists and engineers and academic experts, recently developed a Technology Bill of Rights which incorporates the principles of the social criteria which we believe should be included in assessing technological progress. These issues are relevant for office workers as well as manufacturing workers, since microelectronic technologies affect both white- and blue-collar workers.

I would like to enter this into the record, if I may.

Mr. LUNDINE. Without objection, it will be made a part of the record.

Ms. GREGORY. Thank you.

[The information follows:]

A TECHNOLOGY BILL OF RIGHTS

Harley Shaiken

Powerful new technologies are being poured into the workplace at a record rate. Based on the expanding capabilities and decreasing cost of computers and microelectronics, new forms of automation will leave few workplaces or occupations untouched. Robots on the assembly line, word processors in the office, numerical control in the machine shop, computer aided design in the engineering department, and electronic scanners in supermarkets are only a few examples of the widespread changes that are taking place.

While such technologies offer real promise for a better society, they are being developed in a shortsighted and dangerous direction. Instead of benefits, working people are seeing jobs threatened, working conditions undermined, and the economic viability of communities challenged. In the face of these unprecendented dangers, labor must act forcefully and quickly to safeguard the rights of workers and develop technology in a way that benefits the entire society. Key to this is proclaiming and implementing a Technology Bill of Rights. This should be a program that is both a new vision of what technology can accomplish and a specific series of demands that are meant to guide the design, introduction, and use of new techology. This approach is based on the following assumptions:

This document evolved from a meeting on new technology sponsored by the International Association of Machinists in New York on April 30, and May 1, 1981. For more information, contact Dick Greenwood, I.A.M. Headquarters Office (202/857-5200).

1. A community has to produce in order to live. As a result, it is the obligation of an economy to organize people to work.

2. The well being of people and their communities must be given the highest priority in determining the way in which production is carried out.

3. Basing technological and production decisions on narrow economic grounds of profitability has made working people and communities the victims rather than the beneficieries of change.

4. Given the widespread scope and rapid rate of introduction of new technologies, society requires a democratically determined institutional, rather than individual response, to changes taking place. Otherwise, the social cost of technological change will be borne by those least able to pay it: unemployed workers and shattered communities.

5. Those that work have a right to participate in the decitions that govern their work and shape their lives.

6. The new automation technologies and the sciences that underlie them are the product of a worldwide, centuries-long accumulation of knowledge. Accordingly, working people and their communities have a right to share in the decisions about, and the gains from, new technology.

The choice should not be new technology or no technology but the development of technology with social responsibility. Therefore, the precondition for technological change must be the compliance with a program that defines and insures the well being of working people and the community. The following is the foundation of such a program, a Technology Bill of Rights:

1. New technology must tbe used in a way that creates or maintains jobs. A part of the productivity gains from new technology can translate into fewer working hours at the same pay or into fewer jobs. This is not a technical but a social decision. Given the pervasiveness of new forms of automation, the former approach is vital. The exact mechanisms for accomplishing this--a shorter work week, earlier retirement, longer vacations, or a combination--ought to be a prerogative of the workers involved. In addition, comprehensive training must be provided well before any change takes place to insure that workers have the maximum options to decide their future. Moreover, new industries that produce socially useful products must be created to insure the economic viability of regions that are particularly affected by technological change.

2. New techonology must be used to improve the conditions of work. Rather than using automation to destroy skills, pace work, and monitor workers, it can be used to enhance skill and expand the responsibility workers have on the job. In addition, the elimination of

hazardous and undesireable jobs should be a first priority, but at the discretion of the workers involced and not at the expense of employment. Production processes can be designed to fully utilize the skill, talent, creativity, initiative, and experience of people--instead of production designs aimed at controlling workers as if they were robots.

3. New technology must be used to develop the industrial base and improve the environment. At the same time corporate America has raised the flag of industrial revitalization, jobs are being exported from communities, regions,and even countries at a record rate. The narrow economic criteria of transnational companies are causing an erosion of the nation's manufacturing base and the collapse of many communities that are dependent on it. While other countries in the world have a pressing need and a legitimate right to develop new industry, it is nonetheless vital that corporations not be allowed to play workers, unions, and countries against each other, seeking the lowest bidder for wages and working conditions. Instead, close cooperation among unions throughout the world and stringent controls over plant closings and capital movement are in order. In addition, the development of technology should not be at the expense of the destruction of the environment.

The implementation of a Technology Bill of Rights would obviously require profound changes at the collective bargaining table and in the political arena. Unfortunately, the swift introduction of new technology won't wait until the proper mechanisms are available to deal with it.

The labor movement must seize the initiative. This means initiating and proclaiming a Techonology Bill of Rights for workers and the society and making this a central vehicle to mobilize union members, organize the unorganized, and involve the community. In this way, corporate America can receive advance notice that the introduction of new technology is no longer the exclusive perogative of management or an automatic process. Moreover, uses of technology that violate the rights of workers and the society will be opposed.

Instead of only responding to management actions, unions will seek full participation in the decisions that govern the design, deployment, and use of new technology. The goal will be machines that fit the needs of people rather than the other way around.

Ms. GREGORY. In relation to these notions of social criteria in work there is a very important study done by anthropologist Eleanor Wynn. Dr. Wynn worked for 4 years in the Xerox research facilities in Palo Alto, and did her dissertation to develop recommendations for technological innovation.

She notes that "office work is rarely recognized as an intellectual, problem-solving activity," which it is. Consequently, many people involved in creating the automation of the office use a factory model to develop this. Dr. Wynn suggests that the human component, specifically social interaction in office work is integral to the product of the office—processing information.

She recommends when office automation systems are being developed: First, that the office environment be maintained as an environment that enhances human interaction and communication, because that is how the work gets done.

Second, "that the amount of actual decisionmaking and conceptualizing that low-level employees do be acknowledged, and that overt distribution of responsibility be reflected in the systems design."

And third, that systems be designed and sold that help workers to maintain their current work groups and interrelations.

In short, office innovations should be introduced as tools people can use to extend what they do, not in ways that mean people are turned into extensions of computer systems or machines, or feel that they are.

Productivity in the traditional business sense is also not served by some current forms of office automation. First of all, productivity in white-collar work and in the service industries is often ill-defined, undefined, or unmeasurable in any meaningful way. Secondly, management tries to justify rigid standardization of work procedures and computer-based monitoring and measuring of clerical work by saying these are necessary to increase productivity. And yet these arguments do not hold up. A review of research literature on machine-paced versus self-paced work reveals that when the control over the pace of work is taken away from the worker, and given over to a machine or computer-based system, "error rates increase anywhere from 40 to 50 percent," up to 400 percent, depending on the situation one is dealing with.

Finally in certain transaction departments in large insurance companies and banks, it has been found that the work force has been divided into "doers" and "checkers," those who do a transaction and those who check what they do, because alienation and dissatisfaction and often the pace of work results in so many errors. Eventually, 50 percent of the department's workforce in a particular bank were required to check the work of those doing the repetitive, narrow, high-speed task of transferring data from one form to another all day. We believe this clearly indicates that employers would be better off leaving the jobs intact or putting them back together for the sake of job satisfaction and efficient use of human resources.

Very rigid systems also are likely to have adverse effects on the quality of service delivered to clients and customers. Just one example: Blue Shield's office in San Francisco, where a methods-time-measurement study was used about 4 years ago by the company to triple the number of claims examiners had to handle, based on a very rigid video display terminal system, also resulted in that office's performance rating for quality of service sinking to 48th among the States.

To us, all of this means that these forms of excessive managerial control and lack of attention to the human factor are counterproductive as well as threatening to workers' health and well-being.

As for innovation in office technologies, there are instances where innovations which would benefit clerical and secretarial workers and others have been held up in computer industry laboratories because these inventions or designs were not a top priority. For example, in terms of occupational health, higher quality equipment is being produced in some of the Scandinavian countries. According to a report by the Department of Professional Employees of the AFL–CIO recently, better VDT's are produced by IBM in Sweden than the ones they produce in this country.

Innovations in job design, worker health protections on the job, and new forms of worker involvement in development of office systems are being carried out in other countries, reflecting better use of human and technological resources and greater concerns for the effects on people.

In closing, we believe there is a great urgency in challenging and reversing the negative trends in office automation as it is being introduced today. Computer industry analysts predict that in 2 years this will be a "frozen technology," and they predict that within the next 5 years it will be too late to undo adverse effects.

We at Working Women believe that job content, variety of tasks, ability to exercise judgment, recognition for work performed, opportunity to advance, a living wage, social contact with other workers, and a natural work pace, are high on the list of needs of women officeworkers that must be built into the future of office work.

We believe that increased job satisfaction and improved working conditions, can result in addition meaningful measures of increased organizational effectiveness productivity. This will require that leaders from all sectors act now to insure that the automation of the office is not carried out at the cost of the fundamental well-being of officeworkers.

Mr. **Lundine**. Your two stories, particularly the second story, reminded me of one that I have to share with you before I start asking you questions.

A quality of worklife specialist friend of mine was telling me that he went into a workplace—I don't think it was an office—but it was very neat, very clean, very well maintained, seemingly very efficient. He was invited in by the manager, who was very proud of this, and did a little interviewing. He came back and the manager said, "Now, I want to know it straight. What are the problems you see here?" He said, "I think the problem is communication." And the manager said, "Well, I certainly agree. I know the problem is communication. They won't listen to me." He said, "No, I had more in mind two-way communication." He said, "I know. That's exactly what I mean. I have tried memos and I have tried telling them." [Laughter.]

You're really not advocating going back to the era of quill pens, are you?

Ms. **Gregory**. No, we are not.

Mr. **Lundine**. You know, you could take your testimony and sort of conclude that, by criticizing the introduction of technology into the office workplace, you represent people who resent all of that technology. I don't think that's what you are really saying. I guess you're saying they would like to have more control over it, or they would like to have more to say about how it works?

Ms. **Gregory**. Yes. First I think it is important to realize that our view is that the new technologies do have a great potential to upgrade skills and upgrade jobs. And also, that there are many officeworkers who are having positive experiences in one way or another with new technology. Although I will say that in our findings, and from our membership, which are women clerical and secretarial workers, the majority are having the problems which I cited. But I think we can learn from the positive.

Mr. **Lundine**. Can you give us an example of a workplace where there has been a positive experience and where officeworkers have been more involved in the introduction of the new technology?

Ms. **Gregory**. First of all, there are positive individual experiences, and that is a lot of what we hear about. There are differences according to particular jobs within the office and according to the nature of the industry, and the philosophy of the management.

It is harder to describe examples of an entire office workplace. But here's one I can tell you.

When one division in the World Bank here in Washington decided to bring in word-processing technology, I supplied background information to one of the consultants who has worked with groups of secretaries and managers in a joint effort. It resulted in decisions by the different groups to go for a decentralized system, which was slightly more expensive than what the Bank originally wanted to go with. They had thoroughly researched it. There were three study groups on the health and safety aspects, the work tasks and volume of work and how to get that done, and the available technology. And through really learning what the possibilities were, they were able to argue effectively that they should have a decentralized rather than centralized arrangement, that they should have the particular equipment that they wanted rather than other equipment.

Mr. **Lundine**. Can you explain to me basically what you mean by decentralized as opposed to a centralized system?

Ms. **Gregory**. In this instance I was told that the office technology department wanted two measures of centralization. They wanted the word-processing work in the department to be connected directly to a central processing unit within the Bank, so that the office would control it in some ways. But the department wanted to be autonomous, so that is the one level.

The second level is whether you centralize employees into a pool at all, and whether you choose certain individuals to train on the equipment and then they do that work solely. The decision of this group was not to do that. The decision was that no one would work on it for more than 50 percent of the workday.

Mr. **Lundine**. Well, the equipment itself certainly does not require a bullpen kind of arrangement like Professor Driscoll described. I mean, goodness, if we have the capability of typing into a system three States away and having it come out on a typewriter here in Washington, we certainly have the capability for having people working in a bank or an insurance company or another kind of office arrangement in various locations, all of which could be, if needed, centrally operated or a central source for that.

Ms. **Gregory**. Right. That is why I think it is important to have all the employees in the department trained on it, so that it really becomes a piece of equipment that everyone can use in the course of their work, rather than one or two or three or a dozen employees becoming tied completely to the new machine all day.

There is another issue related to decentralization which makes it a trickier concept than it used to be, because of this ability to do things in a geographically dispersed way.

The systems design and the software design can affect work in such a way that you may be not in a word processing pool but you can be just as regimented and just as limited in what you're doing and just as tightly controlled as if you were. In fact you may be more isolated. Decentralization is becoming a more and more difficult and fuzzy term.

Mr. **Lundine**. I think, because of the limits of time, I am going to have to ask if you would give us your recommendations that you talked about earlier.

[The information follows:]

Working Women
EDUCATION FUND

September 16, 1981

RECOMMENDATIONS FOR ACTION ON OFFICE TECHNOLOGY

WORKING WOMEN, NATIONAL ASSOCIATION OF OFFICE WORKERS

to the Science, Research and Technology Subcommittee
of the House Committee on Science & Technology

Hearings on
"The Human Factor in Innovation and Productivity"

WORKING WOMEN, the National Association of Office Workers, believes that strong federal action is needed to protect office workers from the adverse effects of current forms of office automation, and to create a climate in which the introduction of new office technology can benefit workers at all levels. Abundant evidence of widespread occupational health effects -- particularly increased job stress, visual, musculo-skeletal, and nervous system problems -- associated with continuous VDT (video display terminal) work under poor working conditions must be addressed with protective legislation.

Such action by Congress is urgently needed for several reasons: 1) Employers do not willingly take actions needed to protect office workers' health and well-being; 2) More than 90% of all U.S. private sector clerical workers, and more than 80% of public sector clericals, lack union representation and therefore do not have access to collective bargaining as an avenue for improving working conditions or challenging unfair management practices; 3) Office automation is being introduced so rapidly that action must be taken now before irreparable harm is done to office workers' jobs, health and quality of working life.

WORKING WOMEN calls on the Congress to take the following actions:

1) Ensure all U.S. workers certain basic rights in relation to new technologies:
   --The right to advance information about plans for new computer systems as early as possible and before decisions are made;
   --The right to relevant training and education during regular working hours, with employers providing "release time" at full pay;
   --The right to participate in systems design, and the right to funding support to choose technical consultants of their own.

   These rights are guaranteed to workers in some other countries, for example in the Work Environment Act of Norway.

2) Act to protect the occupational health and well-being of office workers by adopting proposed Norwegian regulations limiting work at video display terminals (VDTs) to 50% of the working day, in order to ensure good job design in office work.

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These regulations will require that the other 50% of work time be spent in work integrated with the work at the VDT. They are expected to become the law in Norway in the next few months. (Directorate for Work Council, "Suggested Regulations and Guidelines for Data Terminal Workstations," March 1981, Excerpts entered as an Appendix to WORKING WOMEN's Testimony.)

Furthermore, we urge the Congress to adopt sections of the Norwegian Work Environment Law which require employers to reduce monotony and repetitiveness in work, especially prevalent problems in automated office work.

3. Urge the federal government to adopt the following measures for all federal clerical workers using VDTs, to serve as a model for private sector employers:
   --The proposed Norwegian regulations on work organization in VDT work;
   --The National Institute of Occupational Safety and Health (NIOSH) recommendations for rest breaks (15 minutes per two hours of moderately demanding VDT work, 15 minutes break per one hour of visually intense, high workload and/or repetitive VDT work) and other measures from the "San Francisco Study" NIOSH conducted on VDTs and health problems;
   --Guidelines for VDT machine design features, adopted by the state of Wisconsin for purchase bids on new equipment.

4. Restrict computerized monitoring of work performance, or other methods of computer-controlled pacing and measurement of work, as an invasion of workers' privacy.

5. Direct the U.S. Department of Labor to provide funding support for training initiatives on new technology, especially programs which will benefit those most in need (women and minority workers, older displaced and re-entry workers, and the technologically unemployed) and particularly programs in growth industries where automation is occurring rapidly, such as the service and finance industries.

   Further, direct the Department of Labor to conduct studies to assess the impact of computer technology in key industries such as banking and insurance. Such studies should be designed so that they do not rely solely on employers for data and should examine such issues as:
   --the effects of automation on the pay scale, job descriptions and promotional opportunities of women and minority workers already concentrated at the low end of the pay scale;
   --the particular impact on long-term and older employees;
   --the centralization, monitoring and machine-pacing of work;
   --the impact on the incidence of involuntary part-time and shiftwork employment;
   --the impact on turnover rates;
   --the potential employment displacement effects of the technology.

6. Conduct a study to assess the practices and responsibilities of the computer industry, to examine issues including:
   --safety in design of video display terminals;
   --practices of computer industry sales personnel which promote negative trends such as workplace speed-ups, excessive monitoring, inadequate training, specialization and centralization of jobs, elimination of skilled jobs;
   --delay and suppression of technological innovations and improvements;
   --employment practices of the computer industry itself, regarding women and minority workers and the occupational health and safety of microelectronics assembly workers.

7. Ensure workers a protected right to refuse to work with new computer-based systems if they have not been consulted, if their concerns have not been met, and if they feel their employers are abusing the new technology in ways which devalue, deskill or degrade their jobs, adversely affect their health or otherwise undermine their working conditions.

SUGGESTED REGULATIONS AND GUIDELINES FOR DATA TERMINAL WORKSTATIONS

DIRECTORATE FOR WORK COUNCIL

OSLO, NORWAY MARCH 1981

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Excerpts as an Appendix to Testimony of

Judith Gregory, Research Director, Working Women Education Fund

"The Human Factor in Innovation and Productivity"

Hearings by the Science, Research and Technology
Subcommittee of the House Committee on Science
and Technology

U.S. House of Representatives

September 16, 1981

PREFACE

This publication presents regulations and guidance for equipment and work environment for terminal work stations.

The regulations put firm requirements in order to fulfill the agreement in the Work Environment Act Section 8, Section 9, Section 12, Section 14, and Section 17 n.4.

Any employer or hiring company of workstations is obliged to fulfill the requirements.

The guidance gives suggestions about how the requirements in the regulations and guidance can be fulfilled.
The employer and hiring companies can choose other routines than those given. However, these must give just as good working conditions, preferrably better.

The regulations apply to the equipment as well as to the work station and the organization of work. The last point is important. Present knowledge indicates that the degree of job stress very much depends on the way work is organized.

....

REGULATIONS ON WORKSTATIONS FOR DATATERMINALS

Chapter 4. Organizing the work.

Section 19 Time limitation	If the data terminalwork is to register data or text from enclosures, documents, manuals or others, or other routine work on the dataterminal, the operator shall spend a maximum of 50% of his/her working hours in front of the data terminal. The work must not go on for more than 2 hours at a time, interrupted by a short pause.
Section 20 Other working-routines	The time that is not used for data terminal work shall be filled with work which as much as possible can be related to the work at the data terminal.
Section 21 Education	The person who is going to work on a dataterminal is entitled to an education that gives an understanding of:
Content of education	- The work at the dataterminal and its impacts for the business. - The use and daily maintenance of the equipment. - The basic technical quality of the equipment. - Setting, adjustment and adaptation of dataterminal equipment and other technical equipment at the workstation. - Necessity of good working positions, the use of glasses, breaks and variety in work. - Alternative routines for execution of the work, that can be implemented during hardware errors, etc. - Operators manual and education shall be in Norwegian.

Additional education shall be given at request. The education shall take place during normal working-hours and be paid for by the employer.

Section 22 Control of employee	Registration of data for quantity and quality of work for the individual employee shall preferably be avoided.

GUIDELINES FOR REGULATIONS OF WORKPLACES WITH DATA TERMINALS

Chapter 4. Organization/Preparation of Work

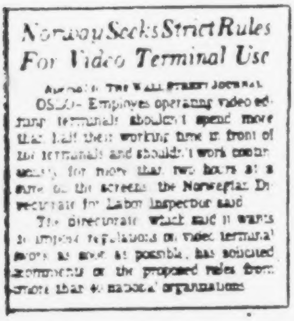
Especially about one-sidedness work	Continuously, uninterrupted data entry on terminal is very strainful. Extreme increase in reported pains often occurs already for operators working 1½ - 2 hours per day. It is important that the ergonomical conditions are as good as possible but this alone is not enough. It is necessary to have variety in such work. Work to be watched over should be organized in a way so that it can be combined with other work such as maintenance or programming.
Limited working hours in front of a dataterminal	The requirement of limited hours in front of a dataterminal has to be looked upon as a tool to obtain more variety in work. It is therefore not a good solution to replace one full-day terminal job with two half day terminal jobs. The work can be less physically tiring, but it will be just as one-sided and have just as little possibility for development as before.
Other working possibilities	Work that can be combined with terminal work should not be chosen incidentally. The physical load has to be considered. Changing from, for instance, a typewriter to a dataterminal will be a bad solution. In cases where terminal work is a part of the job, a limitation of daily working hours in front of the terminal will be unnatural. Examples of such may be program development, procedures, construction work. The final agreement of good organized work must be a result of agreement between the employer and employee in the various companies.
Education	To work with data terminal described in the regulations requires special demands in relation to information and training. It is of special importance that this is given early enough, and to a sufficient extent. The best situation would be if information and training can be given so early that those who shall use the equipment get a good idea of how to participate in the decision of which equipment they as users are best served. The hands-on training must be in connection with implementation periods.

....

Alternate routines	Very often the end user experiences the greatest routines strain in connection with hardware error or heavy load on the DP system, which leads to long response times. It is therefore of importance that the end user is given a training in alternative ways to do the work ....
Control of employees	If individual job information is registered, this should be agreed upon between the employer/employee. Routines should be established to secure the employee on how his/her data are used. This situation is also regulated by other laws and through the agreement.

WALL STREET JOURNAL

MAY 15, 1981



Norway Seeks Strict Rules For Video Terminal Use

[illegible] THE WALL STREET JOURNAL

OSLO—Employees operating video editing terminals shouldn't spend more than half their working time in front of the terminals and shouldn't work continuously for more than two hours at a time on the screens, the Norwegian Directorate for Labor Inspection said.

The directorate, which said it wants to impose regulations on video terminal work as soon as possible, has solicited comments on the proposed rules from more than 40 national organizations.

Video Display Terminal Requirements

Specifications for Bids for Purchase of New VDTs

State of Wisconsin, Department of Administration State Purchasing

Adopted May, 1981

Dr. Steven Sauter, Consultant
Department of Preventive Medicine
University of Wisconsin-Madison

SUMMARY

MANDATORY REQUIREMENTS:

1. Amend the clause regarding the detachable keyboard to include a cable no less than three feet in length.
2. Each terminal screen must have anti-reflection or contrast enhancement features involving thin film layering, etching, micromesh filter, or polarization filters. Preference will be given to terminals incorporating an adjustable polarizing filter laminated between sheets of glass with the glass surface facing the operator treated with an anti-reflection coating. The screen or filter must be easily cleaned by the operator.
3. Each terminal must have an image intensity control readily adjustable by and accessible to the user. The vendor shall warrant that variation in image intensity shall not influence background intensity, image focus, or cause image distortion over the normal life expectancy of the terminal unless these effects can be offset by separate focus and contract controls. Preference will be given to terminals with separate brightness, contrast and focus controls.
4. If dot matrix characters are used, the resolution of the dot matrix must not be less than 5 x 7, with 7 x 9 preferred.
5. There may be no perceptible flicker or jitter in the display image characters.
6. The terminal should not emit high frequency noise.
7. All ergonomic (human factors) features of the terminal must be specified and described by the vendor.

ADVISORY FEATURES:

1. The terminal should be supported by a system which enables rotation about the vertical and horizontal axes.
2. All surfaces including keys, keyboard, and the terminal casing should have matte type (non-glossy) finishes.

3. There should be minimal color contrast among image background, the terminal casing surrounding the screen, the keyboard, and keys. Gray to charcoal coloration is preferred.

4. Convection, as opposed to forced air cooling, is preferred.

5. Exhaust ventilation from the VDT should be directed upward.

6. Character height should be 3 mm minimum.

....

SECTION II: Specifications

B. Terminal Requirements - The State requires video terminals with video screens, detachable keyboards, or equivalent devices as described in the following paragraphs.

1. Proposals must include complete specifications for the proposed video terminal and attachements.

2. The proposed video terminals must be able to be located up to 4,000 feet from local/remote control units.

3. Screen capacities of 480 and 1920 characters are required. Vendors should clearly describe other screen capacities they support.

4. The keyboards must be detachable and interchangeable between similar units by maintenance personnel. The following keyboard types are required:

   - Data Entry
   - Typewriter
   - Numeric Pad.

   Please indicate all available keyboard types and costs.

5. Keyboards must be with standard 3270 function keys. The 75 and 78 key keyboard with the program function keys must be available.

6. Each terminal must be discretely addressable.

7. Both EBCDIC and/or ASCII code structures must be supported.

8. The human factors associated with the terminal will also be considered. Vendors are asked to respond to the following.

   a. Do the detachable keyboards have a cable length of three feet or longer?

   b. Does the terminal screen have an anti-reflection or contrast enhancement feature(s) involving thin film layering, etching, micromesh filter, or polarization filters? Can the screen or filter be easily cleaned by the operator?

   c. Does the terminal have an image intensity control readily adjustable by and accessible to the user? Does the vendor warrant that variations in image intensity shall not influence background intensity, image focus, or cause image distortion over the normal life expectancy of the terminal unless these effects can be offset by separate focus and contrast controls also provided and readily adjustable by and accessible to the operator? Are separate brightness, contrast and focus controls available?

d. If dot matrix characters are used, is the resolution of the dot matrix no less than 5 x 7?

e. Is there no perceptible flicker or jitter in the display image or characters.

f. The terminal should not emit high frequency noises.

g. Is the terminal supported by a system which enables rotation about the vertical and horizontal axes?

h. Do all surfaces including keys, keyboard, and the terminal casing have matte type (non-glossy) finishes?

i. Is there minimal color contrast among image background, the terminal case surrounding the screen, the keyboard, and keys? Describe.

j. Is cooling via convention or forced air?

k. Is exhaust ventilation from the VDT directed upward?

l. Is the character height 3 mm or greater?

m. All ergonomic (human factors) features of the terminal should be specified and described by the vendor.

Ms. **Gregory**. We believe that workers should be guaranteed the right to refuse to work on systems where they have not been consulted and where their concerns have not been taken into account or met.

As you mentioned, the question is how you go about insuring these rights. But those rights do exist, either by law in a few countries you have been hearing about during these hearings, and/or through collective-bargaining agreements in other countries. We think this set of rights are very important.

Mr. **Lundine**. Well, you anticipated my question. You talked about a lot of rights.

Now, are you really suggesting that Congress would establish these rights and that they be enforceable? For example, just to take one, that would restrict monitoring of individual performance as I recall——

Ms. **Gregory**. Yes.

Mr. **Lundine**. So the Congress would be telling business that they can't monitor individual performance; is that right? Is that what your recommendation is, and that that would be an enforceable right by the employee?

Ms. **Gregory**. Yes. That is basically what we're saying, within reason. The key point is the use of that monitoring information. Whether that information is being used to set the pace of work, to speed up the pace of work, and for disciplinary purposes. That is why it's a problem. If these problems weren't happening, we wouldn't be recommending that you restrict this practice.

Mr. **Lundine**. You recognize, don't you, that there is an emormous difference between collective bargaining in this respect and between Government-imposed regulation? In other words, in collective bargaining you have two free agents that are able to come to any kind of accommodation that management and labor can agree on, as long as it doesn't violate some other law, and management is presumably an equal partner to the result of that decision, no matter how hard the negotiation was.

Where Government would impose a regulation, it implies there is no consultation, or it suggests to me that we're finding as a matter of public policy we're telling people how they're going to operate their business without having any negotiation about it.

Ms. **Gregory**. I don't think that is true. That is not the interpretation that I meant for you to take.

One of the reasons why we feel it is important for the Congress to establish a set of protective rights for workers is to encourage consultation which is not taking place between employees and managers. In the office work force today, in the private sector, estimates of unionization are as low as 6 percent. It is going to be a very long time before the other 94 percent of private sector workers have protection through collective bargaining. We feel these are urgent problems.

The set of rights that I described do exist in the work environment law in Norway, and that is a logical form for us to ask the Congress to consider introducing that law.

Mr. **Lundine**. Again resisting the temptation to become the witness rather than the person asking the question, I would merely observe that earlier in the testimony, although it wasn't from Norway but from Sweden, where they have a similar law, an executive of Volvo indicated that they had gone into a quality of worklife program in Volvo substantially ahead of the passage of the law in Sweden, and not in anticipation of the passage of any law, but simply because they thought it was good business, that they still felt and still feel that the Kalmar plant is more productive than any other comparable plants in the world.

I think you would find few Congressmen that would be more interested in the principles you have espoused, but I must say that you have got one that has a great deal of reluctance to think that we can pass a law and that that will automatically solve some of the problems you have been addressing.

Thank you very much for your testimony, thank you both. You have added a perspective which I suspect is going to provide some very interesting reaction as we go along and examine the question of the introduction of technology into the office.

Mr. LUNDINE. Now I would like to call on a panel which includes Donald Erwin of Bell Laboratories, and Ruth Schimel of the State Department.

As you are taking your place, I think I will ask you both to present your statements, and then we will restrict questioning only after you have both presented your statements.

Mr. Erwin.

[The biographical sketch of Mr. Erwin follows:]

Donald Erwin is a human factors psychologist on the technical staff of Bell Laboratories in Holmdel, New Jersey. Dr. Erwin received his B.A. in psychology from Harvard University and his Ph. D. from Brandeis University. Prior to joining Bell Laboratories, Dr. Erwin received research followships from Duke University and Oxford University, and was later employed as a research psychologist at the Army Research Institute in Washington, D.C. At Bell, he is principally concerned with human factors considerations in videoteleconferenicing, and the development of implementation strategies for teleconferencing systems. Dr. Erwin is a member of the American Psychological Association and the Human Factors Society, and has served on numerous scientific advisory panels in the Department of Defense and the National Academy of Science.

STATEMENTS OF DONALD E. ERWIN, HUMAN FACTORS ENGINEER, BELL TELEPHONE LABORATORIES, INC.; AND RUTH SCHIMEL, HUMAN RESOURCES MANAGEMENT DIVISION, OFFICE OF MANAGEMENT, BUREAU OF PERSONNEL, DEPARTMENT OF STATE

Mr. ERWIN. Thank you for inviting me to appear today.

I am a human factors engineer at Bell Laboratories in Holmdel, N.J. I am trained as a psychologist, and I am licensed as an industrial psychologist in the States of New Jersey, New York, and the District of Columbia. I am part of a team of human factors psychologist engineers at Bell Laboratories that is second in size and scope of effort only to the operation for the Department of Defense with which I am intimately familiar, having been an Army employee before Bell Laboratories and as a nonpaid consultant now.

Mr. LUNDINE. Excuse me. I don't mean to interrupt your testimony, but did you say you were licensed as an industrial psychologist?

Mr. ERWIN. Yes.

Mr. LUNDINE. That's interesting. I didn't even know we licensed that kind of thing.

Mr. ERWIN. In the District of Columbia it is a generic license; in New Jersey there is a disciplinary license. I had to present case studies as an industrial psychologist in New Jersey.

Mr. LUNDINE. Fascinating. Apparently the Government is more into this field than I had any knowledge of.

Mr. ERWIN. I am going to be talking to you about teleconferencing today. In two words, teleconferencing is electronic meetings, as was mentioned earlier this morning.

There are three types that I have submitted in my written testimony. First is video teleconferencing——

Mr. LUNDINE. I am going to interrupt you again.

Just for the record, your entire written testimony will be made a part of the record.

Mr. ERWIN. As mentioned earlier today, supposing that we couldn't all be here together in the flesh, our projected video images could be received at different locations and we could have either return audio and video, and we call that video-teleconferencing, or if we didn't have video links, we could have audio-teleconferencing, where a piece of machinery called a bridge at some location could be dialed up by each of us and we could all converse at the same time, audio only. Or, we could all have terminals and communicate with a host computer at some remote location. And supposing we had different time zones or schedules that just couldn't be matched up, we could leave messages, responses, questions, et cetera, so that we would be able to communicate asynchronously.

Now, the question is why teleconferencing. Well, first of all, travel is expensive, not only from a dollar point of view but from a human factors point of view. It takes people out of the office, so it means they are away from the opportunities that may arise in the office; they are also away from managing crises that could occur there. It is disruptive to not only office life but I think, as many of us know who have been forced to travel a lot for our jobs, it is very disruptive to familial and personal life. Of course, that has carryover to an individual's productivity in the office.

Also, the payoff per unit time of travel can be very low. Perhaps for a half-day meeting on the west coast we have to travel a day. Supposing we have a great meeting for 4 hours, but we have spent about 24 getting there and getting back.

Also, teleconferencing can probably be in some cases more productive than face-to-face meetings. Suppose we have a meeting in Los Angeles and we are trying to decide whether or not to send Dr. X to the meeting, because one or two important technical questions might come up.

Well, with the teleconference, Dr. X can sit in his office, doing his work until he is needed. He can be added into the teleconference and answer those one or two technical questions.

Or supposing you're deciding whether or not to lug a couple of documents with you. If you are teleconferencing out of your location, or in the same city where your organization is centered, you can have those documents brought to you during the meeting.

Also, because teleconferences tend to be shorter, because people know they are time bounded, the activity in the conference is usually on a trajectory toward a decision, or some discernible, significant amount of progress. Rather than people saying, "Well, everyone is here. Why don't we pick it up after lunch," they know they have to be done by a certain time and there is less small talk, less talking about the company picnic or the golf tourney the past weekend. People get down to work faster.

I wouldn't want to offer that as a substitute for face-to-face meetings. There are some cases where you just have to be there to press the flesh. Sometimes just the time and money spent in traveling can underscore the gravity of the particular event—for example, a significant personnel action, or opening up relations with a new firm. Some things have to be done face to face.

Now, what are the human factors involved? I am drawing on sources from years of research at Bell Laboratories, research in American academia such as an extensive program conducted at Johns Hopkins University, and also foreign research such as that funded partly by the British Post Office and the University of London for the communication studies group.

Important human factors are, one, the medium has to be very transparent. It has to be easy to use. It can't require technical training. Otherwise, people are not going to use it.

For example, if this was a video teleconferencing room, the control panel that would control cameras, graphics facilities would have to be human factors engineered to be very simple to use. People who are going to use that facility are usually at a level or under the time pressure where they don't have time to learn a complicated control panel.

In a video conferencing room, the lighting has to be such that it is bright enough for color TV transmission, but not so bright as to make people think they are in a studio.

If it is audio-teleconferencing, the system has to be capable of handling highly interactive conversations, interruptions, et cetera.

If it is computer conferencing, it has to be very simple. The control language line has to be easy to use.

Finally, to get people to use it, you have to show them that it is an effective way to communicate, because since day one on the Earth, we have been used to face-to-face communication and most people think they are going to lose effectiveness if they have to do it electronically.

Second, it is not really possible to plop a teleconferencing facility in an organization and expect it to be successful. You have to study the communication culture of that organization, then tailor the teleconferencing facility to match their communicational requirements.

Finally, who is using teleconferencing? Well, 2 months before President Reagan was elected, he spoke to 50,000 campaign workers using a video link to 86 Holiday Inns. Now, he chose to show a videotape. But had he done it live, which he certainly could have, he would have been personally accessible to 50,000 of his campaign workers by return audio.

A number of large companies—IBM, Aetna Insurance, Atlantic Richfield—are all installing teleconferencing systems. Numerous State governments and agencies, too numerous for me to begin mentioning, use audio teleconferencing for not only legislative reasons but also education. There are a number of continuing medical educational teleconferencing networks.

There are journals on the subject. There are meetings of users and vendors. You can buy turnkey facilities. Teleconferencing is out and available in most cases.

To give you a personal example, I use both audio and video teleconferencing in my work. I am setting up a research program with some people at our Murray Hill laboratories. It is 60 miles away. The first time I met with these people, rather than drive an hour and a half, have lunch, and then have a 2-hour meeting, I walked downstairs to our video teleconferencing facility, a trip that takes 15 minutes; I met for 90 minutes, was able to exchange graphic material, saw who these people are because I had not met them, and I was done and walked 15 minutes back up to my office.

Every other Friday, to plan a symposium on teleconferencing this fall; I meet with other scientists in Chicago, New York, Washington, and a couple of other Bell labs locations. We have an audio teleconference at 3:45. Someone calls me and connects me into a bridge, which is an interconnected set of telephone lines, and we talk about what papers we have got for the symposium and how the progress is going. That saves me from having to travel someplace and also means that our work on the symposium moves faster and probably is a bit more effective.

So the idea that I am trying to get across today is that with teleconferencing, it is more important to transmit ideas and information than to transport bodies, and that there are important human factors considerations in successfully implementing a teleconferencing system, because it deals with a very ingrained and natural reliance on face-to-face communication.

[The prepared statement of Mr. Erwin follows:]

STATEMENT OF DONALD E. ERWIN, PH. D., HUMAN FACTORS ENGINEER, BELL TELEPHONE LABORATORIES, INC., HOLMDEL, N.J.

"Teleconferencing: The Human Factor in Electronic Meetings"

My name is Donald Erwin and I am a human factors engineer at Bell Laboratories in Holmdel, New Jersey. Human factors research at Bell Laboratories is conducted principally by psychologists whose goals are twofold: to insure that telecommunications systems and equipment meet the needs of users, and that the systems are as easy to use as possible. I have been involved in human factors work for the past 7 years and have spent the last three studying ways to make teleconferencing systems efficient, effective means for group communication, and analyzing the role of the human factor in successful implementation of teleconferencing facilities. My testimony will review the role of human factors in teleconferencing system design and implementation. I would also like to discuss the particular characteristics and benefits of electronic meetings.

One of the greatest drains on productivity in the modern business world is the business "trip." Apart from the specific purpose the trip is planned to serve, travel usually has little or no additional value, though it does get the traveler out of the office and provides the opportunity for a change of scenery. But for the majority of business travelers, weary of crowded airports and hotel reservation snafus, this "scenery" is far from enjoyable. What most of these travelers would enjoy far more would be the opportunity to conduct the meeting in their own town or even better yet, their own office, where they can carry out business as usual and remain available in the event of unexpected developments, in the office or in their homes.

American business people are beginning to have this opportunity available to them through the development of electronic meetings, often called "teleconferencing." Rather than traveling, the business communicator can transmit words, ideas, and even his or her own image to distant locations to accomplish the meeting or information exchange remotely.

The design, development, and implementation of a teleconferencing system is heavily dependent on thorough consideration of human factors, in both the environment in which the system is introduced and in the users' access to the system. The engineers concerned with human factors focus on the transparency of the teleconferencing system as a communication medium. Human factors engineers are concerned with designing a system that supports and even facilitates communication, rather than impedes it. The more transparent the system is, the more comfortable and "in control" the user will feel. This dimension is critical in designing a system that will be used and may indeed enhance productivity.

First, I would like to review the different types of teleconferencing systems that are available now or will be in the near future. I will also discuss the productivity benefits and costs that these systems can have when utilized instead of face-to-face meetings, and the role that human factors have in insuring that productivity is enhanced through optimal design and use of the facility.

Teleconferencing is interactive communication via electronic media among three or more people in separate locations. Audio and video teleconferencing allow meetings to occur in real time; computer-mediated text teleconferencing can allow for both real time and "off-line" interaction. Conferees leave their messages in the system where it waits for the reaction and response of other parties, who can respond whenever they are ready.

Audio teleconferencing requires nothing more than a telephone, or some form of speaker and phone, which leaves the conferees' hands free. There are three ways that a conference call can be set up. The different parties can be manually dialed and "third" parties added on ... A calls B who adds on C and C talking to B adds on

D, etc. Another alternative is the use of a bridge which conferees access by dialing a particular number. Conferees are added to the bridge and then interact with other parties already attached to the bridge. Lastly, conferees can be dialed from a bridge by a operator. The operator then adds the new conferee to the bridge to join the meeting. Up to about 25 locations can generally be interconnected using these methods. Some bridges are more efficient than others and allow for loss control in signal intensity as the number of participants increases.

Audio teleconferencing can be enhanced by setting up an additional connection for a graphics terminal, or a facsimile machine, electronic pen, or electronic blackboard. With these devices, anything written, read, or drawn in one location can be shared with remote locations. Portraits, photographs, and line drawings can be exchanged with the addition of "slow scan" video, which transmits a complete video image over a phone line in around 35 seconds. This type of equipment allows conferees to see whom they are talking to. Live, full motion video requires completely separate transmission facilities, such as a satellite links or microwave links or cable, interconnecting the various locations. Carefully prepared rooms are required to prevent the teleconference from becoming little more than a television broadcast of a meeting. Truly interactive, full-motion video teleconferencing, that allows for easy dialogue, requires facilities which are easy to use and which do not give users the feeling that they are in a TV studio communicating to a silent, distant audience.

Computer conferencing accommodates both real-time and asynchronous communication. In computer conferencing, users make a local phone call to access a host computer system using terminals which can transmit and receive information through telephone lines. Messages can be exchanged simultaneously or can be left with the system for later response by other users. Computer teleconferencing is the only form of electronically-mediated conferencing in which all the users do not have to be involved or active simultaneously: This is the principal feature of this type of teleconference.

Additionally, computer conferencing is based on a complete written record, providing a transcript of the proceedings as they occur. This transcript is particularly useful when difficult, complex decisions, which are not extremely "time-sensitive," have to be made. Computer conferencing can also facilitate optimal decision-making by eliciting anonymous, candid assessments of decision alternatives, achieving a "Delphi Effect" that otherwise would be implemented through a complex, costly, and time-consuming survey procedure conducted through the mail. (The Delphi Technique is a procedure for obtaining consensus on a problem from a group of experts using iterative, anonymous queries of opinion or decision alternatives. See references [1] and [2] for details.)

All of the types of teleconferencing which I have described are available now. Developers and vendors of these systems are continually exploring ways to improve the quality of the visual, auditory, or graphic information being conveyed, increase the speed with which it is conveyed, and decrease the sophistication or complexity of the facility needed to transmit the information. In recent years, there has been increasing emphasis on engineering of teleconferencing systems so that they are easy to use and which facilitate, rather than impede, the processes of group communication. Human factors research in this area has sought to characterize how different types of teleconferencing differ from one another and from face-to-face meetings. This research has begun to provide an information base that is critical in determining what type of teleconferencing facilities is appropriate for an organization's communication needs, what implementation strategies will insure proper and continual use, and how that facility can be best utilized to enhance productivity and reduce unproductive travel time to face-to-face meetings. Evaluation of teleconferencing systems has begun to demonstrate that there are a variety of benefits to be had from teleconferencing which go beyond cost displacement or cost avoidance from reductions in travel.

Next, I would like to discuss how the various forms of teleconferencing differ from one another in terms of the effect they can have on group communication relative to face-to-face meetings. And, I would like to review what are some of the most important contributions that teleconferencing can make to enhancing productivity in American offices, and how "needs assessment," implementation, and evaluation are the three critical steps in maximizing this productivity enhancement.

Audio-only meetings have been found to be adequate for a wide range of business and research tasks in which the emphasis of the communication problem is one of information exchange and/or problem solving [3]. Several surveys of types of meetings generally conducted in business environments have indicated that a large percentage could be conducted by audio or audio plus graphics teleconferencing [4]. These meetings can be more effective than their face-to-face counterparts.

For example, an audio meeting can be much more task-oriented than a face-to-face meeting. In an audio teleconference, the topic being discussed is the focus of everyone's attention. Individuals are not distracted by the visual channel that may be carrying irrelevant or imprecise information [5]. Some research has shown that in an audio teleconference, in which bargaining or negotiation is going on, more opinion change occurs than in face-to-face meetings [6]. Furthermore, the side with the more comprehensive or stronger case is more likely to win in an audio-only interaction [7]. We do know that information conveyed in audio teleconferences is attended to more closely, and task performance dependent on this information does not suffer because of lack of a visual channel.

Participants in an audio teleconference usually realize that they are limited in the time which they have access to the audio bridge or the particular audio teleconferencing facility. Consequently, people come better prepared and get down to work faster. Audio teleconferences are usually much shorter than face-to-face meetings [8]. And without visual distractors, closer attention is paid to the substantive issues raised during the teleconference. Audio teleconferences are also more "democratic:" the frequency and extent of contributions tends to be driven more by participants desires to contribute and less by implicit or perceived role hierarchies that tend to emerge in face-to-face meetings. Dominant, controlling individuals are more easily controlled by the group, allowing for more orderly, businesslike proceedings.

Both audio and video teleconferences are capable of bringing a greater range of personnel resources to the meeting than a face-to-face conference. Experts needed for one or two pieces of valuable input or interpretation can be included in a teleconference whereas they may have been excluded if their travel had to be funded for a face-to-face meeting. In this way more information can be brought to bear in a forum that is already more task-oriented, more democratic, and consequently, potentially more productive than a face-to-face meeting [9].

The addition of a video channel in teleconferencing expands the capabilities of an audio-only system by giving participants a greater feeling of social contact than an audio-only or audio plus graphics system [10]. When the establishment of interpersonal relationships is important, the addition of video can meet this need. But internal group structures and hierarchies still do not emerge as quickly as in face-to-face meetings. Although video teleconferencing is a "richer" communication medium in that it will allow for real time exchange of nonverbal information amongst communicators, research results are mixed on the extent to which problem solving in video meetings proceeds more efficiently and accurately than in audio teleconferences. There is much more variability in the way video teleconferencing is implemented than in the use of audio or audio plus graphics teleconferencing. From the Bell System's PICTUREPHONE™ Meeting Service Trial to studio-like, one-use set ups, video teleconferencing takes many more forms in terms of equipment, room layout, audio and video quality, and the "transparency" of the system for facilitating efficient, productive meetings.

Computer teleconferencing differs from audio or video conferencing in that the focus is on printed messages conveyed in real time to another person at a terminal, or left in the host system for access at some other time by conferees at other terminals. Consequently, computer conferencing is not dependent on time and space. It can be an excellent vehicle for groups that are widely dispersed and whose communication needs can be phased or sequenced in time, such as in project management situations, in which accurate, candid assessments of technical progress are needed as they occur. In this context, computer conferencing can be a useful adjunct or follow-on to an audio or video conference that starts a project rolling. The only equipment required for computer conferencing is a phone line and a terminal, with access via a dial-up code to a host computer system that stores and distributes messages and interactions.

Human factors research and analyses have demonstrated that the three types of teleconferencing I have discussed (audio, video, and computer teleconferencing) share a number of the same advantages over face-to-face meetings in facilitating more productive, efficient communication in business meetings. The extent of these advantages depends in large part on how well the equipment has been designed so that it is easy to use and is a comfortable, available alternative to face-to-face communication. Some of the advantages of teleconferencing over face-to-face meetings that users can enjoy are the following.

First, face-to-face meetings require travel. The disadvantages of travel go far beyond cost and energy consumption: the traveler is out of the office and can maintain only sporadic contact with what may be important developments there. Crises can arise or opportunities present themselves while the traveler is fighting traffic from the airport to his or her destination. And the impact that travel can have on the personal life of the individual, and the disruptive effect that this impact can have on personal productivity cannot be discounted.

Second, teleconferences tend to be shorter, more task driven, and more decision-oriented than face-to-face meetings. Conferees tend to be better prepared when they start a time-limited teleconference. There appears to be less motivation to talk about the company picnic, or the weekend's golf tourney: everyone gets down to business more quickly. And the orientation of the communication is towards making a decision or achieving some discernible amount of progress, rather than "picking it up after lunch."

Third, teleconferences facilitate access to a greater range of personnel expertise and information than face-to-face meetings. When individuals have to travel to a meeting, decisions have to be made about who to send and what information to bring. Questions like, "Is it really worth it to send Dr. Smith to LA to answer one or two technical questions?" Or, "Should I bring that portfolio of backup data?" arise constantly in trip planning. With a teleconference, information and individuals can be included as needed. Experts needed to answer a question can be added to an audio teleconferencing bridge after a phone call to their office, where they have been working productively until their participation in a conference is needed. Because audio and video teleconferences also tend to deemphasize emergence of role hierarchies, participation is more democratic. Information that might be suppressed because the conferee with the information is more subordinate to most of those in the meetings, or is somewhat hesitant to volunteer information, has a better chance of being elicited by the discussion of the problem at hand, rather than by attempting to perfect social conditions for uninhibited participation. Consequently, the information base available during the analytic or decision-making process in a teleconference is much broader and potentially more productive than in a face-to-face meeting. More participants are available and can be made part of the decision-making process. This is important not only to the quality of the decision but to motivating individuals as well.

Fourth, teleconferencing can be a adjunct to, rather than a substitute for, travel. Some meetings have to be held. The organizational meeting for a new project, a significant personnel action, or an occasion where the mere physical presence of the conferees, given the time and cost, is needed to define or underscore the seriousness or magnitude of the endeavor are some typical examples. In these cases, a face-to-face meeting can be an important and necessary communication event, whose impact can be supplemented and continued through teleconferencing. Meetings which would otherwise not occur (but need to), can be scheduled as teleconferences. For example, after a division vice president flies to a distant site to be involved in the start up of an important manufacturing process, monthly or bimonthly audiographic teleconferences for progress reporting can keep the communication channel alive and well, and the vice president's presence felt. The teleconference can take 90 minutes rather than 24 hours out of the office to collect the progress report in person. Teleconferencing can also allow individuals to participate in meetings while traveling. For example, while headed to the airport or driving across town, the executive who has left a meeting can continue to participate using a mobile telephone link to an audio teleconferencing bridge. In the same way, emergency or crisis situation that require the opinions of experts who do not share radio facilities with emergency vehicles can be brought together and converse telephonically with on-site personnel equipped with mobile telephones.

And fifth, teleconferences, because they are electronically mediated, can be captured in their entirety with a magnetic tape or a computer file, providing a complete meeting record. Consequently, the entire meeting is available to those who could not be involved or who can learn from what transpired. Most face-to-face meetings only survive in the memories of the participants or in meeting reports or synopses prepared days later.

The realization of these advantages of teleconferencing over face-to-face meetings depends on the extent to which there has been a careful assessment of an organization's communication needs, sound implementation strategies developed, and an evaluation or assessment plan designed to determine just what sort of effect teleconferencing is having on the communication culture and productivity of the organization. Human factors specialists have begun to play an increasingly larger role in these activities, designing and administering surveys, creating performance monitoring schemes, monitoring and assessing fluctuations in system usage and traffic patterns, and designing the personnel and operating subsystems to support a large network of teleconferencing facilities.

Prior to the introduction of a teleconferencing system in an organization or firm, a thorough analysis of the target organization's communication culture and needs is critical. In some cases, potential users have been queried as to what their expectations are regarding teleconferencing: If they would use it, how it would affect their normal modes of operation, and what costs and benefits they feel would accompany use of the facility or capability. These costs and benefits can range from changes in personal communication effectiveness to impact on the operation of the department, division, or company. This information becomes very important in developing an implementation strategy that addresses itself to existing organizational hurdles and misperceptions regarding teleconferencing. In addition to this sort of survey, it is critical to understand the meeting behavior of the organization. To what extent are graphics an important component in most meetings, what levels and varieties of personnel usually get involved, what are the "power politics" of meetings in the organization, what is the usual duration of meetings, etc., are the sort of questions that have to be answered.

Implementation of teleconferencing systems or facilities should begin with the designation of an implementation team composed of a high level manager, a manager, whose normal activities cover telecommunications (such as a data processing manager), and a series of functional representatives to different organizational areas, such as personnel, production, or administration. Implementation in these areas should be application, rather than task, directed. That is, teleconferencing should not be proposed as the solution to a particular problem or task, because then resolution of the problem or task could terminate the perceived utility of the teleconferencing system. Instead, implementation should be directed towards achieving productivity enhancement in overall functioning. It is for this reason that the evaluation and assessment of the implementation of teleconferencing becomes a component in insuring and optimizing its benefits. A group or team that develops a means for measuring increased responsiveness of staff, shorter meetings, wider (more democratic) involvement in problem solving, better planning and follow through in project management as a function of use of teleconferencing facilities can encourage and stimulate usage, making the teleconferencing capability or facility part of the communication culture of the organization, rather than a novel appendage or "toy." One of the most important considerations in successfully implementing a teleconferencing system is getting individuals to perceive the system as a real alternative to travel. Communicators have to realize that they can be as, if not more, effective when they teleconference. And, they have to realize the host of other benefits that accrue from not traveling, such as less personal disruption, increased access to information and people during meetings, and quicker closure on decisions. Evaluation and assessment of benefits after implementation is the way that these effects can be demonstrated. Teleconferencing can be mistakenly perceived as communication reduced in "bandwidth" from face-to-face meetings, or meetings that are less effective just because they are electronic meetings.

It is more important to transmit ideas, information, and agreements than it is to transport people. From corporate productivity through more effective, decision-oriented communication to decreased disruption of personal and family life, the benefits for the American worker and for the efforts in which he/she is enlisted are many with the widespread implementation of teleconferencing systems. Successful use of teleconferencing depends on the design and development of systems and facilities that are easy to use and which facilitate, rather than impede, the communication dynamics that make for effective meetings. And the benefits and advantages of teleconferencing are important to demonstrate to potential users to overcome the very human reliance on face-to-face interaction as the best way of communicating person-to-person.

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Mr. LUNDINE. Thank you. Miss Schimel.

Ms. SCHIMEL. Thank you very much for having me here. First, let me give you a brief description of my background. For the last 18 years, I have been a Foreign Service officer. During this time I have had several assignments as a manager in the personnel and consular areas. I have also done political analysis. My undergraduate degree is in industrial and labor relations; I completed my master's degree in public administration in 1977 and am currently working on a doctorate in the same area.

I am particularly interested in the areas of productivity, work and aging, the nonconventional uses of mediation skills, and a lot of the considerations that you are dealing with during these hearings.

The office I would like to talk about is my own. It is the Human Resources Management Division in the Bureau of Personnel at the Department of State. We have six analysts, including myself, and one secretary. Our primary work is work-force planning, analyses of present and future personnel policies and the development of improved personnel management procedures within the Department of State.

So as you can imagine, we produce a lot of paper. The particular problem that we face is that we have one secretary for six analysts. Until the last year, we used Selectric typewriters and we had two Lexitron word processors that we share with other offices. Often the analysts themselves worked directly on the word processors, creating their own drafts, and taking the draft to final copy. Just because of the sheer problem of producing for so many people, one secretary couldn't possibly support all six analysts in a timely way.

More than a year ago one of the analysts in our office—I can't take credit for this; this happened before I even came—recognized the problem of productivity and started looking into the use of optical character readers which would obviate the need for putting the data input directly on the Lexitron word processors.

Basically, what you do with the opticial character reader is you type your drafts and mark in red ink. Then you insert your draft directly into the optical character reader and the text appears on the video display terminal for editing. It saves a tremendous amount of time.

This analyst looked into about 12 different optical character readers and narrowed the field down to three. So presently what we have is a situation where five of us use Selectric typewriters, we have the two Lexitron word processors, and we have an optical character reader. We are leasing the Lexitrons and the OCR, the optical character reader.

The important thing to mention in this process of choosing the equipment was that although the excitement of what this equipment could do was extremely important, the human factors of introducing new technology was equally important. We were interested in how comfortable people felt with the new equipment, their comfort with the techniques and the procedures and how OCR use affected their job satisfaction.

For the analysts, for example, less satisfaction would mean not being able to control their creative effort from beginning to end.

For the secretary, it was in the sense of perhaps being replaced by a machine, as the secretary described her feelings.

One of the ways that we dealt with introducing the new technology, aside from explaining its use, was to have one-on-one discussions. Jon Jackson, who was the analyst responsible for OCR, went out of his way to answer questions that dealt with anxieties. We all exerted a little peer pressure when some people seemed to be resisting use of the new equipment and made sure that the rules that we decided on were applied fairly and consistently.

What I am talking about is a process that started in 1975-76, when we first got the Lexitrons, and is continuing today, even though we have used the optical character reader for the last year. We still have problems with it, whether it is downtime or whether it is queing for who has access to the equipment. So bear in mind that, although I am talking about the introduction of new equipment in a linear way, we are still dealing with the effective use of the equipment as we go along.

What we found when we finally got our configuration of equipment in place was that it was not a panacea. There were lots of problems. The analysts, as I mentioned before, had some adjustments to make. We found the machine itself made a lot of noise, and since it was placed in the secretaries' area, it also took some of their space away.

The things that continue to be of concern to us, aside from the sense of identity and control being threatened, are physical problems that seem to be connected with equipment uses, especially the Lexitron word processors.

For example, our secretary has back problems and occasional eye problems. We found that putting a shade on the video display screen helped the eye strain. However, we have not been able to get the proper kinds of chairs because of restrictions on Government purchasing. As a result, Diane Harrison still has occasional problems with her back as do other people who use the equipment.

One of the things I find fascinating is how you divorce the stress that comes with change, per se, from what may be purely physiological kinds of reactions to the use of new equipment. I will mention that later when we talk about things we might explore.

Some of the things we tried to do to ameliorate problems with our equipment was to use static-free rugs at the base of the Lexitrons. We also removed some of the files from the secretary's space and apportioned them among the analysts' offices. Now we are looking into the possibility of leasing an optical character reader that is less noisy, so that the secretaries don't have to live with a constant hum in the background.

We have also established what I call rules of etiquette to discourage the analysts from congregating in the area where the equipment is. As several people have pointed out, there are social aspects to the use of the equipment. What we tend to do, since we're a fairly convivial office, is to congregate where the equipment is and to talk about various issues that we're concerned with. That's fine, except for the two secretaries who work in that area. So every once in a while we have to renew our commitment to our rules of etiquette to make sure we respect the secretaries' territory.

Another consideration in the introduction of new equipment is the importance of reasonable expectations, that it will not be a quick fix. There is a period of adjustment. Many of the promises that are made regarding what the new equipment will do will not necessarily pan out. So the manager who expects some kind of magical change to occur because of new equipment is going to have to exercise a lot more patience and utilize many of the management skills that are required for effective office operation. In any event, the manager must make sure that both the technology is used effectively and the people who are using the technology are not affected disadvantageously and can get benefit from the use of the new equipment. Benefits should not merely be thought of in productivity terms, but also in terms of a sense of meaning about what they're doing, whether it is job enrichment or whether it is just giving them more choices about using their time.

Another important consideration is that all users are involved with the decisionmaking process, not merely regarding the type of equipment, but the process for introduction and the physical arrangements. In addition all users should have some opportunity to create the rules for use.

As I said before, I think one of the areas that we know the least about is the relationship between how people respond to significant changes in their environment per se, and the physical problems that seem to be allied to the use of office technology like eye strain and back problems. There are other issues that perhaps we're not even aware of yet.

The sense of identity that was mentioned earlier today I think is extremely important; how does the introduction of this equipment affect people's definition of themselves, how they feel about their value to a particular operation? What kind of environment do you have in an office so that people can even talk about those feelings? Merely talking about the technical aspects of the introduction of equipment I think is just a very small part of the process.

It is very easy for a manager to make a decision to bring in sexy equipment. It may enhance his or her image; it makes everybody look good. However, the people who have to actually use the equipment are the ones perhaps who are the most important in the whole decisionmaking process, not only because they make the equipment work effectively but also because introduction of equipment affects their commitment and productivity.

I have written testimony that goes into detail about the process that we used to introduce equipment, some of the pitfalls that we faced, some of the things we did well, some of the things perhaps we could have done better. It may help individual managers who are going through the process of introducing new office technology. I hope it does.

[The prepared statement of Ms. Schimel follows:]

MANAGING DISTRIBUTED WORD PROCESSING: A SUPERVISOR'S VIEWPOINT

The purpose of this testimony is to describe the development and use of distributed word processing in a specific office, identify the opportunities, problems and issues we face and suggest topics for study based on our experience. The setting is the Human Resources Management Division, Office of Management, Bureau of Personnel, Department of State.

Our office does workforce planning, manages the Alternate Career Planning program, develops new personnel policies, suggests improvements in present personnel procedures and analyzes current and proposed policy. We have one secretary and six analysts, including the division chief. To produce our narrative papers and statistical tables, we use six IBM selectric typewriters, two Lexitron word processors and a Compuscan Alphaword II optical character reader. Of the six analysts, five use selectric typewriters; all six do most of their drafting on the typewriters or directly on the Lexitrons.

Each analyst has a small office; the secretary shares her work space with another secretary who works for the director of the office of management. With the exception of the analysts' typewriters all word processing equipment and most files are located in the secretaries' area.

People from other offices use our equipment when it is available. Thus there is a continuous flow of people through the secretaries' area which also serves as a reception space.

A brief description of how our word processing approach evolved is relevant because it reflects an incremental approach to creating an effective word processing system. Previous supervisors installed Lexitron equipment in 1975-76. Before I became chief of the division in 1980, one of the analysts had already investigated the possibility of adding an optical character reader (OCR) to alleviate the bottleneck at the point of data entry into the two Lexitron word processors. The OCR would also permit direct data entry into a Wang VS minicomputer which may be accessible to the Division in the future.

The continuing interest of the analyst was the catalyst in acquiring the optical character reader. As the chief of the division, I had only limited previous experience with the management and use of word processing equipment. However, my concern with providing the means for turning out timely work with one secretary for six analysts made me support the case for the OCR. In addition, we viewed our experience with the OCR as a possible prototype for other offices. If we used the equipment to good effect and provided access to word processing equipment to other offices, our experience might be useful for others.

The analysts in our office had become dependent on drafting their work directly on the Lexitrons. Although five of the six analysts had their own selectric typewriters, the Lexitrons provided instant editing capability and were psychologically satisfying to our wordsmiths. They could turn out finished copy without waiting for the secretary to do all final drafts.

But the queues for the word processors, which included people from our office and others, resulted in unnecessary squabbles over the use of the equipment. Even more important, we found that we were unable to provide timely products with our present word processing configuration. A vendor study noting that about 80% of the time involved in using word processors was for data entry and 20% for editing and final copy confirmed our experience.

The next step was to evaluate various optical character readers to decrease the time spent on data entry and increase the speed of turning out final copy. That we had an adequate supply of selectric typewriters adaptable to IBM elements created an ideal situation.

We investigated about a dozen optical character readers, and narrowed the field to three. After reviewing the advantages and disadvantages of each, we decided to test the Compuscan model because its reading capabilities were fast and accurate; it could interface with the Wang

VS minicomputer and could be hooked to the Lexitron equipment. This analysis of OCR capabilities focussed on obtaining management approval, both from our office of management and the Information Systems Office (ISO) of the Department of State. Although we were convinced of the advantages of our approach, ISO, as internal consultants, had some reservations. We overcame these reservations by deciding to lease the equipment on a trial basis to test its effectiveness. Annual lease cost, including service, was about $12,000 per year.

Once ISO and Personnel management gave approval, we made arrangements to lease the equipment and coordinate installation with Lexitron to make the OCR and Lexitron word processors compatible. This took about three months with both vendors to arrange for wiring, procurement and installation. Concurrently, the analyst who had taken the lead on getting the OCR, started to develop procedures for use. He carefully explained the process for using the equipment in group and one on one meetings and developed a set of priorities for use of the equipment to ensure that the transition from old habits would be as smooth as possible. Our present secretary had not yet been assigned so she was not involved in some of this process.

When the OCR was actually installed in October 1980, it had an adverse effect on the secretaries for several reasons. They did not fully understand how it would work; the equipment itself had a constant hum; and perhaps most important the OCR took up already limited space in their bailiwick. The division secretary said she felt she was being replaced by a machine. She wondered why we needed the OCR if she could handle the workload, but did not express this concern until later when we discussed the matter.

Obviously the analysts and the secretary had different perceptions regarding the need for the equipment. In addition, the OCR equipment resulted in visits from people outside the office who were interested in using the equipment. The resulting activity and conversation caused more distractions in the secretaries cramped area. Clearly the analysts and visitors had to avoid congregating in the common area. We therefore added this requirement to our "users' etiquette." We also removed some furniture and files from the secretaries' area.

But the adjustment to the new equipment was not confined to the secretaries. The analysts themselves had to change their word processing input habits; although they could still use the Lexitrons for drafting, we had established that OCR processed drafts for input to the Lexitrons had priority over those that were drafted directly on the Lexitrons. This compensated somewhat for the loss of the instant gratification provided by drafting and editing directly on the Lexitrons.

How did this adjustment to new procedures work out? Within several weeks of applying the procedures for use, most analysts started to be comfortable with the new approach to data input from the selectric typewriters to the OCR to the Lexitron. When one analyst tried to revert to previous methods, peer pressure usually succeeded in returning the person to what had become mutually agreed upon procedures.

For the analysts, adjustment to the OCR as an intermediate step in producing final copy went relatively smoothly. For the secretary, however, the adjustment was not merely an issue of feeling cut out, although that in itself was significant. She had eye strain, her back bothered her, and the noise from the OCR was an added aggravation. Each of these issues had to be addressed. We put shades on the video display screens to cut down glare, and we encouraged her to seek medical advice in the health unit of the State Department. We have still not been able to obtain better chairs to relieve back strain because of restrictions on obtaining new furniture. Finally we are considering a quieter Compuscan OCR model.

During the past year, both the OCR and Lexitrons have been sporadically out of commission. We relieved this problem by obtaining special rugs to reduce static, but because of cost constraints were unable to purchase the most effective static reducers. Even today, either the OCR or Lexitron is down about two to three times a month due to problems with header sheets, programming tapes and the age of the Lexitrons. This requires calls to the vendors and causes delays in processing our drafts.

Our discussions about using the equipment to the best advantage for all continue. The secretary says she is getting used to the new processing procedures and equipment; she finds the approach faster and more flexible and reports that she is able to process drafts twice as fast as it would take if she used a conventional electric typewriter. We have decided that more than a few hours at a time spent using the Lexitron video display screens create too much eye strain for her. So she now paces herself. With the flexibility provided by the electric typewriters, OCR and Lexitrons, it is rare that we are unable to meet deadlines because of inadequate word processing equipment.

What did we learn from the development of our word processing approach? First, analysis and choice of effective equipment in itself does not do the trick. All users, especially the secretary, must be involved in the decision making process about the type of equipment, the process for introduction, physical arrangements for placement of equipment and etiquette for use. Second, expectations that new equipment will be the equivalent of the second coming will only be thwarted. For new equipment is unlikely to work perfectly and be consistently available for use. The situation is exacerbated when two different vendors are responsible for maintaining one system There is sometimes ambiguity about whose part of the system is malfunctioning when the entire system goes down. Third, we still do not know the relationship between the stress of change per se and physical problems that seem to be related to use of the word processing equipment.

In itself, the introduction of OCR capability may make some secretaries feel less useful or perhaps inadequate. That the equipment is considered necessary in the first place may imply the secretary is not meeting expectations, whether the expectations are reasonable or not. In our situation, the fact that any secretary would have difficulty answering phones, serving as a receptionist, distributing paper, filing and typing for six analysts did not assuage her feelings that she could not handle the office's requirements.

With the passage of time and familiarity with the advantages of our word processing equipment, all users think that the present situation is a significant improvement over the past. But our dialog about problems and issues must continue and we need to keep tabs on the patterns of equipment breakdowns. Finally, we must still obtain better seating arrangements and ensure that the analysts respect the secretaries' need for quiet in their area.

From our experience, we think that even the measured approach we took does not entirely avoid problems of adjustment. Whether it is the analysts' attachment to old equipment that gave them control from conception to final copy, the need of ensuring commitment to new procedures and etiquette, equipment breakdown or the secretary's physical and emotional discomfort, the use of new office equipment requires continuing attention. Effective word processing is not a panacea, but in our case it significantly improved the speed of processing our work.

PER/MGT/HRM:Ruth Mara Schimel, September 3, 1981

Clearance: A/ISO - Douglas Stevens

Mr. LUNDINE. Thank you very much. Thank you both for your testimony.

Mr. Erwin, you gave the example of President Reagan speaking to 50,000 campaign workers at the same time in a teleconferencing arrangement, which fascinates me because I get fascinated by things I don't understand, which are almost infinite.

If that was a two-way system, my question is, who would decide which question of which campaign worker in some Holiday Inn somewhere across America gets heard and gets answered? Do you see what I mean?

Mr. ERWIN. Yes; 86 locations and 50,000 people is big. Usually it is smaller—continuing education for sales managers, 10 locations, 5,000 people.

In each of those locations you have a moderator, and then at the broadcasting location you have someone who is controlling the conference. He would poll the 10 locations asking for questions, taking them from the floor.

Mr. LUNDINE. Then the moderator would get them in writing and decide which ones were going to be asked or——

Mr. ERWIN. No; he could do it in real time. Say on a PA system which would be connected to the audio feedback system to the broadcasting location, he would say to maybe a thousand people, "Are there any questions", and then—I have been in situations like this—a microphone is brought to you in the audience and you ask the question directly.

Mr. LUNDINE. Well, I'm just a little slow.

Let's suppose we had eight rooms around this building—in fact, thank you very much for offering. We almost used this technology as a part of these hearings and we appreciate your offer in that regard. We just couldn't get the witness to agree to it. The introduction of new technology doesn't always work. Witnesses aren't always agreeable either.

But let's suppose we had eight rooms like this around wherever. It doesn't matter how far they are away from one another. Let's suppose that I'm the moderator and I say "Any questions". Now, do we take time out from this aggregate sort of teleconference so that in this room people can say—and you're the moderator for this room—they can tell you their questions and then you, as a moderator, will speak up and say "We've got some questions in the Science and Technology hearing room". Is that essentially how it works?

Mr. **Erwin**. Right. You would poll the different rooms. You would say, "Mr. Erwin in 3235, do you have any questions?" I would say yes, and then I would probably have a microphone taken to the individual with the question.

Mr. **Lundine**. OK.

You sort of touched on this, but how much of it is really going on in American business? Is there a way you can give me an example of how much teleconferencing is penetrating as a replacement for traveling and having meetings?

Mr. **Erwin**. One metric would be the number of professional meetings. There are an increasing number of meetings of users and vendors. I know within the Bell System there was a 12-city, 3-year trial of video teleconferencing that recently stopped because it was an experimental situation, and there was application to create a 43-city network.

I can name companies now that are installing video conferencing, and there are literally hundreds and it would not be unreasonable to say thousands of organizations that use audio teleconferencing.

Mr. **Lundine**. Major corporations usually?

Mr. **Erwin**. And organizations like State governments, continuing education departments, medical schools, et cetera.

Mr. **Lundine**. In your business experience, do executives respond to this as well as intermediate level management employees?

Mr. **Erwin**. Yes; particularly higher executives who have to travel a lot.

Mr. **Lundine**. That's what I mean.

Mr. **Erwin**. In some cases, when there is an introduction of a teleconferencing facility, it is from top-down pressure. A higher level executive officer will say, "I am sick of traveling; I want teleconferencing." Once the person has used it a few times and becomes comfortable with not playing with face-to-face strategies and types of interactions that a lot of people employ, then they become more task-oriented in their teleconferences and they are very happy and pleased with it and not having to travel.

Mr. **Lundine**. Can you give us any idea of cost? You pointed out there is a saving, and the American airline industry had better be ready for it, but it costs something, too. How expensive is a typical teleconference?

Mr. **Erwin**. Well, it is a wide range. Supposing you wanted to connect 20 locations, do it internationally. You could rent or lease access to a bridge, which interconnects locations, on the order of a hundred dollars or so an hour. You could lease or buy a unit that could be placed on this table for audio teleconferencing that would be on the order of, say, 400 or 500 hundred. If you wanted to buy a fully equipped video teleconferencing room, it would be on the order of a quarter of a million dollars.

Mr. LUNDINE. I don't want to get into commercials, but what kind of companies are the vendors of this?

Mr. ERWIN. Well, the Bell System currently has applied for permission to construct a 43-city network with a completely dedicated facility for video teleconferencing subject to the regulatory process.

Mr. LUNDINE. So you would sell it or lease it to other businesses?

Mr. ERWIN. Yes.

Arco is doing the analysis to build an eight-location facility——

Mr. LUNDINE. Of their own?

Mr. ERWIN. Of their own.

Mr. LUNDINE. That they presumably would market to other people, or just for Arco use?

Mr. ERWIN. I don't know what their plans are. It is conceivable, what you suggest.

Other large firms, Ford Aerospace, Honeywell.

Mr. LUNDINE. You touched on it, but it must be a tricky decision to decide which kind of meetings really do require personal contact and which do not. I wonder if, based on your experience, you could make any observation about that.

One of the previous witnesses, Professor Driscoll, mentioned that we had breakfast today. I am not sure if that has redeeming social or economic value or not. But, you know, I guess politicians are uniquely oriented to pressing the flesh. At the same time Members of Congress could certainly benefit as people who are facing traveling a whole lot more than your quality of life would indicate that you ought to. It is intriguing. And yet it strikes me that it would be a very difficult decision to make as to which meetings you get more out of by just having lunch with someone, having an opportunity to not having to have a specific agenda. You used a phrase, "less small talk."

Well, don't you think there is some value to small talk?

Mr. ERWIN. Yes, I do. I would answer your question not only from personal experience but from my knowledge of the research literature, which is fairly extensive on this topic. There have been simulated teleconferences where tasks have been manipulated, different types of tasks, and the progress and problem solving has been measured, and also user opinion, which has been polled, and then also in the work we have done at the labs.

When you expect there would be a large interpersonal component in the success of your meeting objectives—say you don't know someone and you're going to persuade them to do something and you feel that your case may not be as strong as you would like it to be, you will have to use a lot of body English and persuasive interaction, et cetera—then you have to meet face to face. So in cases of persuasion, attempting to personally influence individuals, face to face is important.

But at the other end, supposing you want to get the best decision on a technical matter as possible, something like computer text conferencing, where you can insure the anonymity of inputs and people have a chance to digest text, it probably gives you the best quality decision.

In video teleconferencing we recommend and my feeling is, the first time you're going to meet with people, video teleconference. You kick off the project and you get to see the people and it's a rather significant event. Then for project updates and management, audio teleconference, because without that visual component, people are even more task oriented.

There has been research which shows that the rate of problem solving in video and audio teleconferences is not different.

Mr. LUNDINE. Miss Schimel, I am going to ask you something outside what you testified about.

Is the State Department doing any of this teleconferencing?

Ms. SCHIMEL. Yes, we have had experience in using the anonymous approach to decisionmaking in the Bureau of Personnel. We had quite an imaginative Deputy Assistant Secretary who wanted to use that as an approach. We have used it in both deciding priorities for the use of our resources and also at offsite conferences in determining our objectives for the Bureau.

I would say the results are somewhat mixed because the managers themselves who are willing to use this approach have to take the next step and use the anonymous response in their decisions. Some managers may feel as though they'll lose control. So what happens, for example, if the anonymous response is antithetical to managers' point of view. I think, as you mentioned, this is especially a good approach when the facts are fairly clear cut.

Mr. LUNDINE. Is it used at all internationally as far as you know? I mean, within the State Department.

Ms. SCHIMEL. Not that I know of.

Mr. LUNDINE. There are fascinating possibilities there, too, that occur to me, and problems.

Well, let me go into what is more your area of expertise.

Was your secretary involved in the selection of the new equipment?

Ms. SCHIMEL. The present secretary we have, Diane Harrison, wasn't in the office when Jon Jackson first started looking into the optical character readers. I think that was a great disadvantage. She was peripherally involved because she came at just about the time we were beginning to get the equipment. I think that her lack of involvement with the process from the beginning made her adjustment somewhat more difficult, aside from some of the more practical reasons I mentioned, like the noise and space problems.

Mr. LUNDINE. You mentioned the rules you decided on, and then later in your testimony the only rule I heard was how often you congregate around the machine.

Ms. SCHIMEL. That's right, not make noise.

Mr. LUNDINE. Can you give me another example of a rule that you decided on?

Ms. SCHIMEL. Yes. For example, people who wanted to draft directly on the Lexitrons rather than have their drafts put through the optical character reader would not have priority. In other words, any work that was done for processing through the optical character reader would have priority over the the work done directly on the Lexitron.

Mr. LUNDINE. You're all on a level, in terms of the hierarchy, you're all equal?

Ms. SCHIMEL. Yes and no. I'm chief, and we have different grade levels in the office. But I would say our particular office is one of the least hierarchical in terms of the way we actually operate.

Mr. LUNDINE. So if you're the chief, your stuff doesn't always go first?

Ms. SCHIMEL. No. I have to make choices about priorities, and I could be overruled if the analysts presented a good case to me. I mean, we could fight about it. So far we haven't come to that point, though.

Mr. LUNDINE. I'm not sure I understand exactly how this works, partly because I don't understand the jargon well enough. But explain it to me.

Ms. SCHIMEL. We have modular offices, small cubicles. There are six of us. Five of the six analysts use Selectric typewriters. Those Selectric typewriters have typing elements whose characters are accepted by the optical character reader. So when we type our drafts, rather than writing them out in long hand, which five of the six of us can do, the piece of paper can be put directly into the optical character reader——

Mr. LUNDINE. Does that happen automatically?

Ms. SCHIMEL. We have to take the paper and physically put it in, feed it into the optical character reader, and then the optical character reader transfers that information to a tape which can be inserted in the Lexitron word processor. Then the full text appears on the screen. Then all you have to do is use the Lexitron for editing, or for final copy.

Mr. LUNDINE. Is this smart—I mean, if you made a typo, would it tell you possibly that?

Ms. SCHIMEL. No, it wouldn't pick up the typo. But you can self-correct. You can correct your own typing as you go along using symbols that can be read by the OCR.

Mr. LUNDINE. The reason is, you know, you get fascinated with the gadgetry, too, and I saw one—a bugaboo of mine is the spelling of the word "principal". I saw one where he misspelled it and it said "didn't you mean p-l-e?"

Ms. SCHIMEL. There may be some machines that can do that, where they are programed for a particular spelling. But ours does not.

Mr. LUNDINE. That's not the most important thing that I want to know. I just want to understand how it works.

So when would you make the decision about which function the equipment does first? At the start of the day, or periodically as you go along?

Ms. SCHIMEL. It is a fairly informal process. The main criterion that we use is the due date of something, the importance of something in terms of where it is going and what the issue is. Increasingly our secretary has taken over more responsibility for determining the priorities as we give them to her.

Mr. LUNDINE. The secretary determines that?

Ms. SCHIMEL. Now she is beginning to do that. We are starting new procedures. And I am sort of like a court of last resort, if there is a conflict. It never has really gotten to that. We want as much as possible for Diane to be able to manage this, rather than just be a cog in the process.

Mr. LUNDINE. This is fascinating. I was thinking of yesterday, when I finally did get back to my office for a few minutes, three or four of us sat around editing something that we were all collaborating on.

Would this have the capacity of feeding changes in text into the equipment and then producing different people's suggestions when you are looking back at it and editing it? Do you follow what I mean?

Ms. SCHIMEL. I think so. Our particular equipment can't do that. But what we do do sometimes is a few of us may congregate around a screen where one of the analysts is working on something and we all want to have some input into it, and make suggestions as we see the text appear on the screen. That is one way of doing it.

Mr. LUNDINE. So, in essence, your system is just like mine so that if the four people were working on something, we would say "any comments on page 1, any comments on page 2," except that you have got a screen instead of——

Ms. SCHIMEL. And we can make the changes very quickly through keyboarding them, that's right. It is a fairly down-to-earth system.

Mr. LUNDINE. Finally, given that you have had some involvement in the selection of the new technology, can you assess what the advantages and disadvantages are in terms of your quality of working life?

Ms. SCHIMEL. My personal or the office?

Mr. LUNDINE. Your personal. I don't want an office evaluation. How is your job better and how is it worse as a result of that?

Ms. SCHIMEL. It is very difficult for me to divorce myself entirely from what is happening in the office, because my quality of life depends on the degree of peace, harmony, and productivity that we have in the office.

First of all, we can process our drafts more rapidly, and I know, for example, personally that what I write becomes final copy much more quickly. Diane reports that she can actually process our drafts almost twice as fast using the optical character reader.

So from a personal point of view, I have much more immediate gratification in seeing the results of what I have written.

Also, I think in terms of the environment in which I'm working there has been improvement, because people are working together more harmoniously. There is less conflict, not that we ever had a tremendous amount. But let me put it positively—there is more ease in the way we queue up and the way we decide our priorities. There is a certain intrinsic fairness in the way the work is handled, less ambiguity.

Mr. LUNDINE. I want to thank both of you very much.

The next panel will include Mr. Travis Marshall, vice president and director of Government relations, Motorola, and Mr. Raymond Demere, vice president of manufacturing services for Hewlett-Packard Corp.

[The biographical sketches of Messrs. Marshall and Demere follow:]

TRAVIS MARSHALL

Mr. Marshall is Vice President of Motorola Inc. and Director of Government Relations. His office is responsible for Motorola's interface with all branches of the Federal Government and State Governments and for Motorola's spectrum management policies with all countries.

Marshall is Industry Vice President of the Communications Division of the Electronic Industries Association and Treasurer of the Association. He is also a member of the Department of Commerce's Industry Sector Advisory Committee on International Trade.

Prior to assuming his current post in 1973, he was Vice President of marketing Operations of Motorola's Communications Division.

RAYMOND M. DEMÉRÉ, JR.
Vice President
Manufacturing Services
Hewlett-Packard Company

Ray Deméré was born in 1921 in Savannah, Georgia. He was graduated from Yale University in 1943 with a bachelor of science degree in industrial administration and engineering. During his Naval service, he attended technical school at Notre Dame, Cornell, Harvard and Massachusetts Institute of Technology.

Deméré joined the staff of Hewlett-Packard Company in 1946, and for the next 13 years he served the company in a number of capacities, including product engineering, quality control and production management. From 1959 until 1962, he was general manager of HP's manufacturing plant in Boeblingen, West Germany. He returned to the States in 1962, and for the following three years was the company's corporate Customer Service Manager. In 1965 he was appointed general manager of the Loveland (Colorado) Division.

In March of 1970, Deméré returned to Palo Alto and was named operations manager with the responsibility for the direction of the manufacturing divisions in the Electronic Products Group.

In December of 1971, he was elected a vice president of the company, and in September of 1974 was named operations manager of the Instrument Group.

In September, 1977, he was appointed vice president, Manufacturing Services. In this position he is responsible for planning, developing and coordinating policies to optimize the company's manufacturing capability. He also is responsible for corporate materials planning & procurement, establishing companywide design and manufacturing standards, corporate assurance engineering, corporate physical distribution and corporate environmental safety & health.

Deméré serves on the National Board of Directors of Junior Achievement and is a member of the Institute of Electrical and Electronics Engineers.

9/8/81

STATEMENTS OF TRAVIS MARSHALL, VICE PRESIDENT AND DIRECTOR OF GOVERNMENT RELATIONS, MOTOROLA, INC.; AND RAYMOND M. DEMERE, JR., VICE PRESIDENT, MANUFACTURING SERVICES, HEWLETT-PACKARD CO.

Mr. **Lundine**. We have both of your statements here, and we will make them both a part of the record. You may proceed in any way you would like Mr. Marshall.

Mr. **Marshall**. Thank you, Mr. Chairman. I would choose to paraphrase some and then read parts of it, if I may do it that way. For the purpose of saving time, I would paraphrase some of it.

I would like to share with you some of the successful programs that we at Motorola have installed to mobilize our human resources for the competitive battles created by technological improvements.

Motorola designs, sells, and manufactures high-technology electronics equipment and systems. Our semiconductor sector was the first to produce commercially the 64K RAM, random access memory, chip, which is a computer on a fingernail-sized chip. We think we will be the first to introduce the 128K or 128,000 chip in that same division.

Our communications sector, by the way, manufactures much of the communications link for the pictures I see around this room, with the exception of the one on your lower left down here. We didn't do that one because it's a different country. But we are in that high-technology business also.

Our automotive division, of which many of the employees are in your district, Mr. Chairman, manufactures an engine device which automatically tunes your automobile engine as you're driving along, another product of the future.

Our data division, which is headquartered in Mrs. Heckler's district—too bad she isn't here to hear that—manufactures data modems, making it possible for computers to talk to each other over telephone lines, and they manufacture other data communications equipment. Essentially, all of our products are in the high technology area.

Over a third of our sales are to customers located outside the United States. And for more than 90 percent of our sales, we compete with non-U.S. manufacturers. We have had some major successes, and we look forward to a lot more of them.

One that our communications division is involved in, and we think will be a success in a matter of weeks, is the sale of a high-technology product to Nippon Telephone & Telegraph, the first non-Japanese company to sell to the Japanese telephone company a high-technology product.

Indispensable to our successes have been our people. And a major factor encouraging the contributions our people have made is our attitude. We do not hire an individual simply to operate a machine or to run a department or run an office, but that person we expect to make a contribution to the success of the entire enterprise. We believe that this is proved and reproved many times each day by the success of this attitude.

Several years ago we codified that attitude in a document entitled "For Which We Stand"—and I will read that particular part, if I may. It has been 5 or 6 years since we did it, and it is something that we tell to all employees of Motorola.

> Participation: To provide the opportunity for the largest number of employees at all levels to participate in the management of their work . . .
>
> Proprietorship: To maintain an attitude of personal proprietorship on the part of the managers of each of our businesses or departments and product lines, so that every person involved can identify with the success of a particular product or business.
>
> Entrepreneurship: To encourage an entrepreneurial spirit by providing a climate in which new venture ideas can be nurtured and brought to fruition.

There are those who say that that attitude invites disappointment and failure, that the American worker of today has lost the work ethic and is interested only in short-term, materialistic, self-gratification. Those prophets of doom also contend that the American manager is inadequately trained and improperly motivated to seek short-term gains at the expense of the longer term future. We hear this frequently when we are compared with Japan, for example.

I would like to respond to that by saying, according to the television commercials, the very paradigms of the "me generation" will practically break their necks to excel in order to win a Michelob Light. Now, we don't reward our people with Michelob Lights, but I think the broader message of these commercials is accurate, that the "me generation", like all other generations, enjoys winning and wants to excel. We base what we do on those principles.

We are convinced that American workers can be the best and most productive in the world, and in many industries they already are. In the U.S. semiconductor industry, for example, productivity, as measured by value added per employee, increased by 300 percent in the 6-year period from 1975 through 1980. When American workers are not productive, it must be because there is something or someone holding them back, demotivating them, dampening their instinctive urge to excel.

The criticism of American managers as poorly trained and too short-term oriented, while valid in some cases, is not at all universally true. If we provide the tools and the climate in which managers can excel, they will. If they don't excel, perhaps the company is doing something wrong.

The subject of managers takes me to the first of the successful Motorola programs I want to share with you this morning.

In industries marked by frequent and rapid technological change, such as those in which Motorola operates, the competition posed by technological advancements puts a tremendous pressure on the research and development organization to perform.

Many firms have made the mistake—and we have in earlier days—of selecting to manage the R. & D. organization on the basis of relative skills as an R. & D. scientist. Perhaps some believed that the best R. & D. scientist would perforce be the best R. & D. manager. But others felt boxed into that decision out of concern that promoting someone else would send a signal to the best scientist that his or her contributions were not important.

One way in which we have addressed that problem is by creating what we call the "technical ladder". It is a series of increasingly higher level jobs to which a scientist can advance on the basis of nonmanagerial contributions, and yet have equivalent status and rewards within the company as someone proceeding up the management ladder—I might add we have done that also in our marketing area—all the way to officer of the technical staff, the equivalent of an appointed vice president. We don't claim we have invented the concept of the technical ladder, but we heartily endorse it.

We have for many years had a similar concept on our assembly lines and it works well there also. Just as the best R. & D. scientist is not necessarily going to be a good R. & D. manager, so the best assembler may not be cut out to be an assembly line supervisor. When we find such a person, we cross-train them in as many as possible of the tasks on that assembly line, then promote them to what we call "key operator." The key operator is like a utility infielder on a baseball team, only at Motorola the utility infielder, because of his or her versatility, is paid more than the first baseman or the shortstop.

Our objectives in both cases are to take advantage of and reward each individual's distinctive competence, whether that be as an individual contributor or as a manager.

Another set of people-related problems we are addressing with success is the shortage of people educated and/or trained in the technical skills and disciplines we need. A prime example is the job of electronics technician. Electronics technicians are the people who test, diagnose, repair, and maintain electronic parts and products. In most places there is a severe and rapidly growing imbalance between the supply and demand of these technicians.

At our Fort Lauderdale, Fla. plant, however, we took the lead in establishing a highly acclaimed CETA program that trains assemblers to be electronics technicians. We were so gratified with the results of that effort that we are in the process of establishing counterpart programs in other communities where we have major facilities. The program supplied our needs for electronics technicians and provided major advancement opportunities for the assemblers who entered it.

While working on that Fort Lauderdale program, we learned that some secondary school vocational counselors were not aware of the job and career opportunities available at the many electronics firms moving into the area. So we brought these counselors to our plants, showed them what the opportunities for jobs were, and where the students were most needed by us. As a result of these visits, the counselors are now better able to help their students and, in the process, will help us.

Another skills supply shortage we have experienced is due directly to technological advancement—a technological breakthrough creates a scientific specialty for which the schools have no curriculum. The key here is to maintain a close relationship with the school, tell them where we are going in product, or suggest to them what they can follow and what they should be doing in the curriculum.

The centerpiece of our programs and the one I would cover last is our program that we call participative management program, or PMP. Our chairman has repeatedly expressed his conviction that Motorola does not have a single problem or deficiency to which someone or some group of people do not have the answer. It is our job as managers, he has told us, to provide an environment in which those answers will surface regularly and promptly. PMP is the environment we have chosen.

The structure of PMP is regular meetings of each work group to thoroughly discuss all matters relating to the employees' work environment and their jobs to answer questions fully and completely, explaining management decisions in a way that lets the employee see the rationale behind those decisions; and to sincerely solicit the employees' ideas and suggestions for improvements. That last part is really the major part of it, to get their participation in it. If solving a problem requires the cooperation of another work group, representatives of the two groups will get together to work it out.

Our PMP programs are tied in with group incentive compensation plans. The employees participate in setting their work group's performance standards. If the group exceeds those standards, they are financially rewarded. It is clear to us, though, that it is more than the prospect of a larger paycheck that motivates our people, for they keep setting ever tougher standards for themselves. They want very much to be proud of themselves, their work group, as well as their company.

It is simple in concept, but not simple to install. We are asking managers and employees to make fundamental behavioral changes. It takes a while but we found it is worth it and eventually they will all accept it.

Let me close with an observation, and that is that technical competition, by pushing resources into R. & D., creates a pressure to cut costs in other areas. We should be extremely wary that the costs we cut do not diminish the effectiveness or the motivation of the most important resources we in American business have—our people.

Mr. Chairman, I applaud the committee's efforts through these hearings to optimize the utilization of America's human resources in the worldwide technological competition. I hope Motorola's experience will assist in this vital undertaking.

[The prepared statement of Mr. Marshall follows:]

Statement of Travis Marshall, Vice President and Director of Government Relations, Motorola, Inc.

Mr. Chairman and members of the subcommittee, my purposes in appearing before you this morning are two:

First, to raise our company's voice in opposition to the defeatist chorus that regularly proclaims the inferiority of the American worker and the American manager;

And *second*, to share with you some of the successful programs we have installed to mobilize our human resources for the competitive battles created by technological improvements.

Motorola designs, manufactures and sells high-technology electronic components, products and systems. Our Semiconductor Sector was the first to produce commercially the 64K RAM, the fingernail-sized "computer on a chip" that can perform over 64,000 different functions, and we believe that we will likewise be the first to produce the next generation of microprocessors, the 128K RAM. Our Communications Sector stands to become the the first non-Japanese firm to sell high-technology electronics -- in this case miniature pagers or "beepers" -- to Nippon Telephone and Telegraph. Our Automotive and Industrial Electronics Group is developing an electronic engine-management system that will literally tune your car while you drive it. Our Government Electronics Division designed and manufactured the cameras on Voyager II, whose photographs are both fascinating to the layman and invaluable to the scientist. And our Data Communications Organization, headed by our wholly owned subsidiary Codex Corporation (with its headquarters and principal manufacturing facility in Mrs. Heckler's district and a subsidiary of its own in Mr.

FLIPPO'S DISTRICT) IS A LEADING PRODUCER OF HIGH-SPEED MODEMS -- INTERFACE DEVICES THAT ALLOW COMPUTERS TO TALK WITH EACH OTHER OVER THE TELEPHONE -- AND OF MULTIPLEXERS--DEVICES THAT SUBDIVIDE TELEPHONE CHANNELS SO THAT MANY COMPUTER-TO-COMPUTER CONVERSATIONS CAN OCCUR SIMULTANEOUSLY.

OVER A THIRD OF OUR SALES ARE TO CUSTOMERS LOCATED OUTSIDE THE UNITED STATES. FOR MORE THAN 90 PERCENT OF OUR SALES WE COMPETE WITH NON-U.S. MANUFACTURERS.

WE HAVE HAD SOME MAJOR SUCCESSES. WE LOOK FORWARD TO MANY MORE.

INDISPENSABLE TO OUR SUCCESSES HAVE BEEN OUR PEOPLE. AND A MAJOR FACTOR ENCOURAGING THE CONTRIBUTIONS OUR PEOPLE HAVE MADE IS OUR ATTITUDE. WE DON'T HIRE AN INDIVIDUAL SIMPLY TO OPERATE A MACHINE OR TO MANAGE A DEPARTMENT BUT FOR THE TOTAL CONTRIBUTION THAT PERSON CAN MAKE TO THE SUCCESS OF THE ENTERPRISE. WE DON'T SUBSCRIBE TO THE VIEW THAT PEOPLE HAVE TO BE CAJOLED OR COERCED INTO WORKING. ON THE CONTRARY, WE BELIEVE -- AND THE ACCURACY OF OUR BELIEF IS PROVED AND REPROVED MANY TIMES EACH DAY -- THAT IF WE MAKE EACH PERSON FEEL AN IMPORTANT PART OF OUR ENTERPRISE, THE VAST MAJORITY OF PEOPLE -- OF WHATEVER NATIONALITY -- WILL RESPOND BY DOING THEIR BEST TO MAKE THAT ENTERPRISE A SUCCESS.

SEVERAL YEARS AGO WE CODIFIED THAT ATTITUDE IN A DOCUMENT ENTITLED "FOR WHICH WE STAND -- A STATEMENT OF PURPOSE, OBJECTIVES AND ETHICS." LET ME QUOTE THREE BRIEF PASSAGES FROM THAT DOCUMENT.

"PARTICIPATION. TO PROVIDE THE OPPORTUNITY FOR THE LARGEST NUMBER OF EMPLOYEES AT ALL LEVELS TO PARTICIPATE IN THE MANAGEMENT OF THEIR WORK. . . .

"PROPRIETORSHIP. TO MAINTAIN AN ATTITUDE OF PERSONAL PROPRIETORSHIP ON THE PART OF THE MANAGERS OF EACH OF OUR BUSINESSES AND PRODUCT LINES SO THAT EVERY PERSON INVOLVED CAN IDENTIFY WITH THE SUCCESS OF A PARTICULAR PRODUCT OR BUSINESS.

"ENTREPRENEURSHIP. TO ENCOURAGE AN ENTREPRENEURIAL SPIRIT BY PROVIDING A CLIMATE IN WHICH NEW VENTURE IDEAS CAN BE NURTURED AND BROUGHT TO FRUITION."

THERE ARE THOSE WHO SAY THAT THAT ATTITUDE INVITES DISAPPOINTMENT AND FAILURE, THAT THE AMERICAN WORKER OF TODAY HAS LOST THE WORK ETHIC AND IS INTERESTED ONLY IN SHORT-TERM MATERIALISTIC SELF-GRATIFICATION. THOSE PROPHETS OF DOOM ALSO CONTEND THAT THE AMERICAN MANAGER IS INADEQUATELY TRAINED AND IMPROPERLY MOTIVATED TO SEEK SHORT-TERM GAINS AT THE EXPENSE OF THE LONGER-TERM FUTURE. LET ME RESPOND TO THOSE CRITICS.

ACCORDING TO THE TELEVISION COMMERCIALS, THE VERY PARADIGMS OF "THE ME GENERATION" WILL PRACTICALLY BREAK THEIR NECKS TO EXCEL IN ORDER TO WIN A MICHELOB LIGHT. WHILE OUR REWARDS SYSTEM DOESN'T FOCUS ON MICHELOB LIGHTS, I THINK THE BROADER MESSAGE OF THOSE COMMERCIALS IS ACCURATE -- THAT "THE ME GENERATION," LIKE OTHER GENERATIONS, ENJOYS WINNING AND WANTS TO EXCEL.

We are convinced that American workers can be the best and most productive in the world, and in many industries they already are. In the U.S. semiconductor industry, for example, productivity, as measured by value added per employee, increased by 300 percent in the six-year period from 1975 through 1980. When American workers are not productive, it must be because there is something or someone holding them back, demotivating them, dampening their instinctive urge to excel.

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One way in which we have addressed that problem is by creating what we call "the technical ladder" - a series of increasingly higher-level jobs to which a scientist can advance on the

BASIS OF NON-MANAGERIAL CONTRIBUTIONS AND YET HAVE EQUIVALENT STATUS AND REWARDS AS SOMEONE PROCEEDING UP THE MANAGEMENT LADDER, ALL THE WAY TO OFFICER OF THE TECHNICAL STAFF, THE EQUIVALENT OF AN APPOINTED VICE PRESIDENT. WE DON'T CLAIM TO HAVE INVENTED THE CONCEPT OF THE TECHNICAL LADDER, BUT WE HEARTILY ENDORSE IT.

WE HAVE FOR MANY YEARS HAD A SIMILAR CONCEPT ON OUR ASSEMBLY LINES, AND IT TOO WORKS VERY WELL. JUST AS THE BEST R&D SCIENTIST IS NOT NECESSARILY GOING TO BE A GOOD R&D MANAGER, SO THE BEST ASSEMBLER MAY NOT BE CUT OUT TO BE AN ASSEMBLY-LINE SUPERVISOR. WHEN WE FIND SUCH A PERSON, WE CROSS-TRAIN THEM IN AS MANY AS POSSIBLE OF THE TASKS ON THAT ASSEMBLY LINE, THEN PROMOTE THEM TO WHAT WE CALL "KEY OPERATOR." THE KEY OPERATOR IS LIKE A UTILITY INFIELDER ON A BASEBALL TEAM, ONLY AT MOTOROLA THE UTILITY INFIELDER, BECAUSE OF HIS OR HER VERSATILITY, IS PAID MORE THAN THE FIRST BASEMAN OR THE SHORTSTOP.

OUR OBJECTIVES IN BOTH CASES ARE TO TAKE ADVANTAGE OF, AND REWARD, EACH INDIVIDUAL'S DISTINCTIVE COMPETENCE, WHETHER THAT BE AS AN INDIVIDUAL CONTRIBUTOR OR AS A MANAGER.

ANOTHER SET OF PEOPLE-RELATED PROBLEMS WE ARE ADDRESSING WITH SUCCESS IS THE SHORTAGE OF PEOPLE EDUCATED AND/OR TRAINED IN THE TECHNICAL SKILLS AND DISCIPLINES WE NEED.

A PRIME EXAMPLE IS THE JOB OF ELECTRONICS TECHNICIAN. ELECTRONICS TECHNICIANS ARE THE PEOPLE WHO TEST, DIAGNOSE, REPAIR AND MAINTAIN ELECTRONICS PARTS AND PRODUCTS. IN MOST PLACES THERE IS A SEVERE AND RAPIDLY GROWING IMBALANCE BETWEEN THE SMALL AND DWINDLING SUPPLY OF QUALIFIED ELECTRONICS TECHNICIANS AND AN

ACCELERATING DEMAND FOR THEM. OUR FT. LAUDERDALE, FLORIDA PLANT, HOWEVER, TOOK THE LEAD IN ESTABLISHING A HIGHLY ACCLAIMED CETA PROGRAM THAT TRAINS ASSEMBLERS TO BE ELECTRONICS TECHNICIANS. WE WERE SO GRATIFIED WITH THE RESULTS OF THAT EFFORT THAT WE ARE IN THE PROCESS OF ESTABLISHING COUNTERPART PROGRAMS IN OTHER COMMUNITIES WHERE WE HAVE MAJOR FACILITIES. THE PROGRAM SUPPLIED OUR NEEDS FOR ELECTRONICS TECHNICIANS AND PROVIDED MAJOR ADVANCEMENT OPPORTUNITIES FOR THE ASSEMBLERS WHO ENTERED IT.

WHILE WORKING ON THAT FT. LAUDERDALE PROGRAM WE LEARNED THAT SOME SECONDARY SCHOOL VOCATIONAL COUNSELORS WERE NOT AWARE OF THE JOB AND CAREER OPPORTUNITIES AVAILABLE AT THE MANY ELECTRONICS FIRMS MOVING INTO THE AREA. SO, IN CONCERT WITH THOSE OTHER FIRMS, WE BROUGHT THE COUNSELORS INTO OUR PLANTS, SHOWED THEM THE JOBS WE HAVE AND EXPLAINED WHICH HAD EDUCATIONAL PREREQUISITES AND WHICH WE TRAIN FROM SCRATCH. AS A RESULT OF THESE VISITS THE COUNSELORS ARE NOW BETTER ABLE TO HELP THEIR STUDENTS AND, IN THE PROCESS, WILL HELP US.

ANOTHER SKILLS SUPPLY SHORTAGE WE HAVE EXPERIENCED IS DUE DIRECTLY TO TECHNOLOGICAL ADVANCEMENT: A TECHNOLOGICAL BREAKTHROUGH CREATES A SCIENTIFIC SPECIALTY FOR WHICH THE SCHOOLS HAVE NO CURRICULUM. THE KEY HERE IS TO MAINTAIN CLOSE, ONGOING RELATIONSHIPS WITH THE MANAGEMENT OF THE RELEVANT SCIENTIFIC SCHOOLS SO THAT THEY CAN BE KEPT ABREAST OF DEVELOPMENTS AND AN APPROPRIATE CURRICULUM PUT IN PLACE AS SOON AS POSSIBLE.

I HAVE SAVED FOR LAST THE CENTERPIECE OF OUR PEOPLE PROGRAMS: OUR PARTICIPATIVE MANAGEMENT PROGRAMS, OR "PMP." OUR CHAIRMAN HAS REPEATEDLY EXPRESSED HIS CONVICTION THAT MOTOROLA DOES NOT HAVE A SINGLE PROBLEM OR DEFICIENCY TO WHICH SOMEONE OR SOME GROUP OF PEOPLE DO NOT HAVE THE ANSWER. IT IS OUR JOB AS MANAGERS, HE HAS TOLD US, TO PROVIDE AN ENVIRONMENT IN WHICH THOSE ANSWERS WILL SURFACE REGULARLY AND PROMPTLY. PMP IS THE ENVIRONMENT WE HAVE CHOSEN.

THE STRUCTURE OF PMP IS REGULAR MEETINGS OF EACH WORK GROUP TO THOROUGHLY DISCUSS ALL MATTERS RELATING TO THE EMPLOYEES' WORK ENVIRONMENT AND THEIR JOBS; TO ANSWER QUESTIONS FULLY AND COMPLETELY, EXPLAINING MANAGEMENT DECISIONS IN A WAY THAT LETS THE EMPLOYEES SEE THE RATIONALE BEHIND THOSE DECISIONS; AND TO SINCERELY SOLICIT THE EMPLOYEES' IDEAS AND SUGGESTIONS FOR IMPROVEMENTS. IF SOLVING A PROBLEM REQUIRES THE COOPERATION OF ANOTHER WORK GROUP, REPRESENTATIVES OF THE TWO GROUPS MEET TO WORK IT OUT.

OUR PMP PROGRAMS ARE TIED IN WITH GROUP INCENTIVE COMPENSATION PLANS. THE EMPLOYEES PARTICIPATE IN SETTING THEIR WORK GROUP'S PERFORMANCE STANDARDS. IF THE GROUP EXCEEDS THOSE STANDARDS, THEY ARE FINANCIALLY REWARDED. IT IS CLEAR TO US, THOUGH, THAT IT IS MORE THAN THE PROSPECT OF A LARGER PAYCHECK THAT MOTIVATES OUR PEOPLE, FOR THEY KEEP SETTING EVER TOUGHER STANDARDS FOR THEMSELVES. THEY WANT VERY MUCH TO BE PROUD OF THEMSELVES, THEIR WORK GROUP AND THEIR COMPANY.

It's simple in concept, but not simple to install. We're asking managers and employees to make fundamental behavioral changes. We're saying that, at Motorola, the stereotyped boss-employee relationship isn't the way we work. The boss isn't an autocrat. It takes a while - sometimes a long while - for employees to accept that. It takes a long while for some managers to accept it.

We keep plugging away, though, and we are seeing the necessary changes occur. As they occur, productivity increases significantly.

Let me close with two observations.

First, the American worker and the American manager are not inherently inferior. In many industries they are the undisputed leaders. Americans are natural competitors who love, and strive, to win. It is up to America's corporations to enlist that competitive spirit on behalf of the enterprise by recognizing each employee as an important player on the corporate team.

Second, technological competition, by pushing resources into R&D, creates a pressure to cut costs in other areas. We should be extremely wary that the costs we cut not diminish the effectiveness or the motivation of the most important resources we in American business have: our people.

Mr. Chairman, I applaud the subcommittee's efforts through these hearings to optimize the utilization of America's human resources in the worldwide technological competition. I hope Motorola's experience will assist in this vital undertaking.

Mr. LUNDINE. Thank you. Mr. Demere.

Mr. DEMERE. Mr. Chairman, I am Raymond Demere, vice president of manufacturing services of the Hewlett-Packard Co., Palo Alto, Calif. Our company of 66,000 people is a leading designer and manufacturer of precision electronic equipment used for measurement, computation, and analysis.

I appreciate the opportunity to appear before you this morning to discuss the human factor in innovation and productivity. To me, that human factor is motivation— motivation through establishing trust, caring about people, creating enthusiastic involvement at all levels, and raising people's expectations. Positively motivated people can be very productive and very innovative, and I think very satisfied.

If a company or an organization believes in and practices this philosophy, and fosters technological innovation and high quality, I believe it will be a leader in increased productivity and in successful human relations, and will also have a positive influence upon our society.

Let me expand a little bit about HP philosophy and then give some examples of how it relates to innovation and productivity.

David Packard and Bill Hewlett started more than 40 years ago with several underlying ideals: an earnest desire to contribute; an uncompromising commitment to integrity; and a fundamental belief in the importance of the individual.

As their company grew, they felt the need to write down the company philosophy and its objectives, so that all employees could have a copy. This was in 1957. The formulation and dissemination of these objectives is really a basic cornerstone of HP's philosophy.

The topics on which we have objectives are profit, customers, fields of interest, growth, people, management, and citizenship. We believe in recruiting the best people available, treating them fairly and honestly, investing in their training and development, providing lifetime employment based on performance, making jobs as meaningful and as enjoyable as possible, allowing them to share in the company's success, and in self-financing our own growth.

We encourage informality: first names, shirt-sleeve management, open offices, informal communication across organizational lines, no time clocks, and we have flexible working hours.

All of us share in company profits, and 64 percent of us are shareholders in the company.

We are organized in a manner to carry out this philosophy. Our basic operating unit is a manufacturing division of 500 to 2,000 people, that has worldwide responsibility for its own product line for designing new products, for manufacturing them and marketing them. This size responsibility is large enough for the division to afford a broad range of technical expertise, but yet is small enough so that the division manager can know most of the people, can be familiar with his division and its business, and can exercise entrepreneurship and innovation.

We feel this is important because we are basically an engineering driven company. We often push the state-of-the-art. New products are introduced almost daily. Products that have been introduced within the last 3 years amounted to more than half of our business volume last year.

The company's first product was an innovative design. It was a simple yet an elegant solution to an electronic measurement problem. Since most of our products are used in either engineering or manufacturing, we turn out to be our own best customer. Much of our market research is internal, what we call the "next bench syndrome."

Throughout Hewlett-Packard workers, supervisors and engineers have always been involved in innovation, new tools techniques, organizational structures, and other types of innovation. We continually search for new ideas, both from inside and outside of the company. Several years ago we learned from our Japanese friends that there are two ways to produce high-quality electronic products. One is build in defects, find them and fix them, and the other is to use perfect parts and a controlled defect-free process—in other words, do it right the first time.

Traditionally, we have used the first method involving inspection, trouble-shooting, rework and more inspection. Fortunately, we have been able to achieve success in the area of quality. Our customers have great respect for our quality and we are very proud of that.

But we did take a closer look, after talking to our Japanese friends, and were surprised to learn upon examination that a third of our people, a quarter of our floorspace and two-thirds of our inventory are used in finding defects and fixing them, or reacting to bad quality. These rather alarming numbers were also a source of encouragement, however. They served to increase our expectations dramatically and led to a ground swell of quality improvement programs throughout the company.

For example, our Boise, Idaho, division started a BIMP campaign—that means Boise Improved Methods and Products. All employees were urged to join. If an idea is accepted, a light bulb—for the bright idea—is engraved on the contributor's name tag. In the last 3 years we have had 558 ideas from 321 people, and the savings have been greater than $5 million. This is success through motivation, teamwork, and recognition.

In Cupertino, Calif., we have an example that is really an office example, I guess, following up on the earlier session this morning a little bit. The manufacturing specifications department in that division maintains the documentation that traces the product from its design through its obsolescence. The process was overwhelmed by paperwork. The department members themselves conducted a needs analysis. They worked with people in the design lab and marketing and production. Their result—a plan to enter manufacturing engineering information from each of these sources directly into the computer from the other departments.

By automating certain tasks, the need for people was reduced from 22 to 17. Four of these five displaced people moved to new positions of greater responsibility.

Automation also improved the quality of worklife for those who remained. Their plan required them to learn to use computer terminals. Two of them learned to program the computer—all interesting and new skills.

Incidentally, the revamped department occupies 60 percent less floorspace than it did before.

Production and clerical jobs are not the only ones assisted by automation. Our engineers have been using computers to assist in research and product design for almost two decades. Today, for example, when an electronic circuit can be emulated on a computer, and then optimized and tested for reliability. The accuracy of design we find is 4 to 10 times improved over manual methods. Breakthroughs in design automation have increased the quality of our products and have relieved engineers of much tedious and repetitive labor.

Computer-aided design has also greatly increased our ability to design the tiny silocon chips called integrated circuits, such as it has for Motorola. Just today, we are introducing two new handheld calculators. They use an HP-designed and built chip with 95,000 transistors. Using computer-aided design, it took four person months, for example, to lay out the pattern for this chip. In 1968, 13 years ago, a 150-transistor chip, or roughly one-twelve thousandth the size of this one, took two person months to lay out manually. So just that layout job, in 13 years the productivity has risen 158 times, or roughly 48 percent per year. Much of the tedious work has been eliminated and people are proud of their increase in productivity.

Mr. Chairman, in conclusion, I would like to say I appreciate the opportunity to appear. I believe that the future prosperity of the United States hinges greatly on our ability to break down some of the adversary relationships in our society—relationships between management and labor, between vendors and manufacturers, between business as a whole, and government.

I believe we must more effectively motivate and more thoroughly educate our citizens to increase their capacity for further innovation, higher quality of work, and greater productivity.

I have attempted to convey the motivational aspects of Hewlett-Packard's people awareness philosophy and operating style. I have presented several examples of the human factor related to innovation and productivity improvements. At HP we have raised our expectations tremendously and we will increase our productivity significantly by striving to improve the quality of everything we do. To most of us at Hewlett-Packard, HP also means "have pride." We are very proud to be HP people.

Mr. Chairman, this concludes my presentation. On behalf of Hewlett-Packard Co., I thank you for your attention.

I will be pleased to respond to any questions.

[The prepared statement of Mr. Demere follows:]

Statement of Raymond M. Deméré, Jr.
Vice President, Manufacturing Services, Hewlett-Packard Company
Before the Science, Research and Technology Subcommittee of the House
Committee on Science and Technology, U.S. House of Representatives

"The Human Factor in Innovation and Productivity"
September 16, 1981

Mr. Chairman and Members of the Subcommittee:

I am Raymond M. Deméré, Jr., Vice President, Manufacturing Services, Hewlett-Packard Company, Palo Alto, California. Our company of 66,000 people is a leading designer and manufacturer of precision electronic equipment used for measurement, computation and analysis.

I appreciate the opportunity to appear before you this morning to discuss the human factor in innovation and productivity. To me, that human factor is MOTIVATION -- motivation through establishing trust, caring about people, creating enthusiastic involvement at all levels, and raising people's expectations. Positively motivated people can be very productive and very innovative -- and very satisfied.

If a company or an organization believes in and practices this philosophy, and fosters technological innovation and high quality, I believe it will be a leader in increased productivity and in successful human relations, and will have a positive influence upon our society.

At the Hewlett-Packard Company, we are organized to carry out this philosophy. Our basic operating unit is a product division of 500 to 2,000 people, with worldwide responsibility for its own product line -- new product design, manufacturing and marketing. This size responsibility is large enough to afford a broad range of expertise but small enough for the general manager to understand his division and his business intimately and to exercise entrepreneurship and innovation. This is important because we are basically an engineering driven company; we often push the state-of-the-art; new products are introduced almost daily. Products introduced within the past three years generate more than half of current sales.

We practice participative management and team involvement. Our business segment is always changing and almost always growing. At HP, growth is controlled by our ability to self-finance that growth and to provide permanent employment to our people based on performance. We stress training and development of people at all levels. We practice promotion from within rather than bringing in managers from the outside.

Before I begin to describe some of the human factors in innovation and productivity at Hewlett-Packard, I must share with you our management style and operating philosophy, which were established initially by Dave Packard and Bill Hewlett -- it just came naturally to them. As the company grew, it became desirable to write a "Statement of Corporate Objectives." Originally published in 1957 and essentially unchanged today, a copy is given to each employee. This small booklet serves as the "Magna Carta" for the company and is taken quite seriously. The formulation and dissemination of these objectives in a clearly-stated, understandable fashion, is a basic cornerstone of HP's philosophy. The opening statement is:

> "The achievements of an organization are the result of the combined efforts of each individual in the organization working toward common objectives. These objectives should be realistic, should be clearly understood by everyone in the organization, and should reflect the organization's basic character and personality."

The objectives describe the company's obligation to its people, its customers and society -- to make a contribution. They also describe the employees' obligations to the company and the company's management style.

The statements relate to profit, customers, field of interest, growth, people, management and citizenship. A copy of the objectives is attached, since time does not permit their inclusion in my remarks.

With regard to human factors, HP believes in recruiting the best people available, treating them fairly and honestly, investing in their training and development, providing lifetime employment based on performance, making jobs as meaningful and enjoyable as possible, and allowing them to share in the company's success.

We encourage informality: first names, shirt-sleeve management, open offices, informal communications across organizational lines, no time clocks, and flexible working hours.

All employees share in company profits and are assisted in the purchase of stock. 64% of eligible (at least one year of service) employees are shareholders.

The HP Way is based on an uncompromising commitment to integrity and a fundamental belief in the importance of the individual. Our organizational structure and atmosphere have been developed to support these philosophies.

To get back to my original premise, this operating style can be motivational in generating innovation and productivity.

Our concern here today is productivity improvement and specifically the human factors. Now let me tell you about some of the productivity improvements at HP. Shortly after Dave Packard and Bill Hewlett started the company in 1939, they adopted the slogan, "Inexpensive Quality." They emphasized quality of design: elegant yet simple solutions to customers' electronic measurement problems. HP was one of the first to build sophisticated electronic instruments on an assembly line. Results: semi-skilled workers were more dexterous and produced consistent quality at lower cost, freeing engineers to design the next product. Furthermore, the company philosophy which I described earlier motivated people at all levels to participate in innovation. In the mid-fifties, we adapted the "lazy susan" to electronic assembly, which allowed each person to work at his/her own pace, completing several subassemblies at one time. Integrating the "lazy susans" with "roller skate" conveyor assembly and test lines reduced lifting and handling. This combined effort by workers, supervisors and engineers created a 25% to 30% reduction in assembly times and about the same reduction in defects.

Although we did not fully understand the impact then, 25 years ago, by integrating what had been independent functional operations -- prefabrication, assembly and testing -- on a crude semi-automatic line, we had shortened the manufacturing cycle, increased the feedback, and thereby improved the quality of the process. By improving the quality of the process, we had improved the quality of the product and reduced the cost. HIGH QUALITY COSTS LESS. We didn't really express it in those terms then.

The workers in the different functions cross-trained one another, which added flexibility to the process and heightened their interest. The result was higher morale -- greater teamwork and job satisfaction. By their own innovation, workers had created a process that produced better quality, higher productivity and an improved quality of work life.

Over the years, we continued to improve the quality and reliability of our products by improvements in design and some automation of our processes. We've been proud to have maintained a reputation with our customers as a quality supplier.

Several years ago, when we observed Japanese suppliers capturing consumer electonics markets, we decided to investigate. A study group of a dozen HP manufacturing managers visited successful Japanese companies and returned with dramatically increased expectations about quality and productivity improvements.

One of the most impressive examples came from our own Japanese joint venture, Yokogawa-Hewlett-Packard. Over a two-year period, teams of production workers and engineers made a series of improvements in their circuit board soldering process. They were able to reduce the number of defects from 3500 parts per million to 20 parts per million. At the same time, the production cycle time was reduced from four weeks to three days. Productivity per worker and per square meter improved dramatically. These were the kinds of examples that made our managers so enthusiastic about improving quality and productivity.

We invited Dr. J.M. Juran and Dr. W. Edwards Deming to lecture on their methodology, which had contributed greatly to the Japanese economic miracle.

Throughout HP, many quality improvement programs were initiated for three reasons:

First, our expectations were raised dramatically regarding potential quality and productivity improvements,

Second, our customers were expecting greater quality and reliability, and

Third, quality products cost less to produce.

Now, there are two ways to produce high quality electronic products:

Build in defects, find them and fix them, or

Use perfect parts in a controlled, defect-free process; i.e., "do it right the first time."

Traditionally, we have used the first method -- build in defects, find them, fix them. When we took a close look, you can imagine how surprised we were to learn that an estimated 25% of our manufacturing assets were tied up in finding defects and fixing them, or reacting to bad quality. This was costing us about 20% of sales. Inspecting, troubleshooting, rework and more inspection -- what might be called a "Brute Force" method of quality assurance -- was costing us much more than we thought. One division estimated that if it did everything right the first time, on time, it could get by with one-third fewer people, one-fourth less floor space, and two-thirds less inventory.

These are rather alarming numbers, but they are also a source of encouragement in a sense. They're encouraging because they tell us we can greatly improve our productivity by focusing heavily on a total quality-improvement program. They also make it quite clear that good quality does not cost more. In fact, good quality costs less.

Once you begin studying this theorem, other interesting relationships emerge. For example, the HP product line with the highest profitability also happens to have the lowest production cost as a percentage of sales, the lowest inventory, and the lowest field failure rate. This is not coincidence.

During the past three years, we've launched a number of quality improvement programs throughout the company. I'd like to share with you the results of some of these programs.

Enlisting everybody in the quest for quality and productivity is part of the HP Way. Quality consciousness, however, must filter down from top managers. Their role as managers is to change the expectations and behavior of the organization. They must be the ones waving the flag of quality to gain the involvement of all employees.

Managers of our Boise, Idaho division have made a firm commitment to the concept that the people closest to the action should be the ones thinking up ideas on how to improve quality and productivity.

In December, 1978, the division -- which makes computer peripherals such as printers and tape drives -- began a campaign called "Boise Improved Methods and Products," BIMP for short. The campaign is still going on.

People in every sector are urged to participate. BIMP forms are conveniently placed around the plant. Employees fill out the form and present their ideas to their supervisors. The supervisors in turn present the ideas at a special BIMP meeting, which is held once a month. If an idea is accepted, a tiny outline of a light bulb is engraved on the employee's name badge. This light bulb, symbol of the program, provides recognition to those who contribute.

A whole spectrum of suggestions have been implemented. A photoelectric cell turns off park lights during the day -- saving energy. A cover over a gas line prevents accidental rupture by a forklift -- improving safety. Replacing beryllium copper (used for making encoder wheels) with stainless steel, saves cost and increases reliability.

All told, 558 ideas have been implemented. More than 321 people have had a part in developing suggestions. The estimated costs savings since the program began almost three years ago have been greater than five million dollars. From both a quality/productivity point of view, and from a participation/motivation point of view, the BIMP program has been a great success. It illustrates the value of teamwork, motivation and recognition.

As I have pointed out earlier, the human factor is crucial to quality. We have noticed that the incidence of human error, and therefore low quality, is greatest in jobs that involve repetitive tasks. These are the kinds of tasks that we aim to automate. Now, this does not mean that people will be out of jobs. On the contrary. The quality of their working life improves when automation eliminates deadening routines. More and more, we are finding that workers view technology as a gift rather than a threat. New technology helps them do their jobs better. And in most cases, the higher a worker's productivity, the higher his or her job satisfaction.

Let me illustrate this point with a case study from our Data Systems Division in Cupertino, California. The manufacturing specifications department has this objective: to maintain the documentation that traces a product from its design to the end of its life cycle. Until recently, the process required an overwhelming amount of paperwork. Three people have suffered back injuries lifting heavy trays full of cards. The work was redundant and attrition high. With the help of a summer student intern, employees in the area conducted a needs analysis. They worked with people in the lab, in marketing and in production, and came up with a plan to enter manufacturing engineering information from all these sources directly into a computer.

By automating certain tasks, the need for people in the section was reduced from 22 to 17. Now, that may sound like a problem: five people were put out of work. But that was not the case. It would be more accurate to say that five routine clerical jobs were eliminated.

What happened to those five people? All (except for one elderly worker who died) went to work in positions of greater responsibility. Two became associate systems administrators, one rose to a higher clerical level and one became a marketing illustrator.

Automation also improved the working conditions -- or quality of work life -- for those who stayed in the department. The plan, devised by the workers, required them to learn how to use computer terminals. They viewed this as an opportunity to learn new skills. Their work became more interesting. Two learned to program the computer. One was sent to school at company expense. They have seemed genuinely excited by the gains in productivity and the advances in personal careers brought about by automation. Incidentally, the revitalized department had a more spacious layout although occupying 60% less floor space.

We have another example of the way workers are adapting to new technology. We have a skilled class A painter at our Data Systems Division. A robot has been purchased that is able to do most of the painting tasks currently being done by this painter. This man's job will not be eliminated, but it will change -- for the better. He considers it an honor to be the one selected to teach the robot how to paint. This will involve manipulating the robot into positions that are then entered into the memory of a computer. Through the software and computer controls, the painter will be able to make sure that the quality of his painting technique is reproduced by the robot's motions. As an extension of himself, this new tool will greatly increase his productivity. Quality will be more consistent. The painter still will be there for custom paint jobs, but the repetitive ones can now be done by the machine he supervises. We believe that the HP environment makes these adjustments to new technology non-threatening and actually exciting to our employees. They are assured that they will not lose their jobs because of automation. They are then free to see the benefits of new technology and how it will make them more productive workers.

Production jobs and clerical jobs are not the only jobs being assisted by automation. Productivity and quality advances using computer-aided-design have been startling. Using CAD at our Boise Division for mechanical drafting, the time for designing a finite element model of an impact hammer was reduced from 80 hours to 4 hours, a twenty-to-one improvement.

Our engineers have been using computers to assist in research and in product design for almost two decades. Today, for example, an electronic circuit can be emulated on a computer, and then optimized and tested for reliability. The computer can automatically take into account parameters; such as, component tolerance, temperature and supply voltage. Turnaround time for designs are greatly reduced. Many electronic products are now too complex to be designed by manual methods. Even more important, the accuracy of the design is improved from four to ten times compared to manual methods. These breakthroughs in design automation have increased the quality of our products and have relieved our engineers of much repetitive and tedious labor.

Computer-aided-design has greatly increased our ability to design the tiny devices known as integrated circuits. In 1968, one of our dense chips had 150 transistors. It took a draftsman two weeks to draw the pattern on sheets of paper about six feet by six feet. It took another two weeks for a technician to cut out the pattern on a sheet of transparent laminated foil on an accurate coordinatorgraph. Both the paper and the foil were about 400 times the size of the chip. In order to draw the design and prepare the design for the photographic masking process, two person-months were needed. Thus in this case, our measure of productivity was 75 transistors per person-month.

Just today we are announcing two new handheld calculators. They use an integrated circuit chip with 95,000 transistors. Using computer-aided-design, which includes computer graphics and a plotter, a senior technician is able to layout our 95,000 transistor chip in four months. That gives us a ratio of 11,875 transistors per person-month. Thirteen years ago, we were happy with 75 transistors per person-month. Now, our productivity has risen by a factor of 158 or 48% per year. A significant achievement.

Acquiring these machines brought the engineers great relief from laborious work. Not only did automating improve the quality of their working conditions, but it also improved the quality of their work. The chips designed using computers are of much higher quality than those designed and verified through the manual, tedious process. Many years ago, our engineers took notice of these advantages and they became very receptive to the implementation of this technology. In fact, it would not be practical to design today's very large scale integrated circuits manually. They would be obsolete long before the artwork could be completed.

Our emphasis on quality as the key to productivity has led us to take a closer look at our vendor relationships. Motivating our vendors to provide us with high-quality materials and components is an important human factor in raising productivity.

Greater than one-half of our production costs are for purchased materials; most of our in-process failures and field failures are due to purchased components. We're beginning to develop a closer partnership with our vendors, a better understanding of what we need and what they can deliver from their processes.

For example, last year our Loveland, Colorado, division was displeased with the defect rate of the mercury-wetted reed relays used in quantity in one of our electronic instruments. About 15% were being rejected at incoming inspection and another 10% were failing during production.

Rather than seeking another vendor, we decided to work more closely with our present vendor. To our surprise, we discovered that he didn't understand our application and that we didn't understand his manufacturing process. After developing a close working partnership with the vendor, engineering design changes were made by both parties and quality began to improve. A few weeks after this concentration of effort to improve quality, the vendor shipped 56,000 parts without a defect! Also, the vendor's delivery performance improved dramatically and his costs came down by about 30% as a result of his improved, controlled manufacturing process.

We continue to find that people closest to an operation, the workers executing the process, can contribute greatly to the improvement of the process. We have borrowed the Japanese quality circle technique. This has in essence formalized parts of the HP Way, or operating style, to which we have added problem solving techniques, including statistical quality control methodology. During the past four years, more than 550 quality teams have been formed within HP. They have contributed mightily to improved quality/productivity and to the quality of work life of the participants.

Conclusion

Mr. Chairman, in concluding let me say again that I've appreciated the opportunity to appear before the Subcommittee.

I believe that the future prosperity of the United States hinges on our ability to break down some of the adversary relationships in our society -- relationships between management and labor, between vendor and manufacturer, between business as a whole and government.

I believe we must more effectively motivate and more thoroughly educate our citizens to increase their capacity for further innovation, higher quality work and greater productivity.

I've attempted to convey the motivational aspects of Hewlett-Packard's people-awareness, philosophy and operating style. I have presented several examples of the human factor related to innovation and productivity improvements. At HP, we've raised our expectations tremendously and will increase our productivity significantly by striving to improve the quality of everything we do. To most of us at Hewlett-Packard, HP also means "Have Pride." We're proud to be HP people.

Mr. Chairman, this concludes my presentation. On behalf of the Hewlett-Packard Company, I thank you and the members of the Subcommittee for your attention. I'll be pleased to respond to any questions you might have.

1. HEWLETT-PACKARD OBJECTIVES

The achievements of an organization are the result of the combined efforts of each individual in the organization working toward common objectives. These objectives should be realistic, should be clearly understood by everyone in the organization, and should reflect the organization's basic character and personality.

If the organization is to fulfill its objectives, it should strive to meet certain other fundamental requirements:

FIRST, there should be highly capable, innovative people at all levels throughout the organization. Moreover, these people should have the opportunity – through continuing programs of training and education – to upgrade their skills and capabilities. This is especially important in a technical business where the rate of progress is rapid. Techniques that are good today will be outdated in the future, and people should always be looking for new and better ways to do their work.

SECOND, the organization should have objectives and leadership which generate enthusiasm at all levels. People in important management positions should not only be enthusiastic themselves, they should be selected for their ability to engender enthusiasm among their associates. There can be no place, especially among the people charged with management responsibility, for half-hearted interest or half-hearted effort.

THIRD, the organization should conduct its affairs with uncompromising honesty and integrity. People at every level should be expected to adhere to the highest standards of business ethics, and to understand that anything less is totally unacceptable. As a practical matter, ethical conduct cannot be assured by written policies or codes; it must be an integral part of the organization, a deeply ingrained tradition that is passed from one generation of employees to another.

FOURTH, even though an organization is made up of people fully meeting the first three requirements, all levels should work in unison toward common objectives, recognizing that it is only through effective, cooperative effort that the ultimate in efficiency and achievement can be obtained.

It has been our policy at Hewlett-Packard not to have a tight military-type organization, but rather, to have overall objectives which are clearly stated and agreed upon, and to give people the freedom to work toward those goals in ways they determine best for their own areas of responsibility.

Our Hewlett-Packard objectives were initially published in 1957. Since then they have been modified from time to time, reflecting the changing nature of our business and social environment. This booklet represents the latest updating of our objectives. We hope you find them informative and useful.

David Packard
Chairman of the Board

William R Hewlett
Chairman of the Executive Committee

John Young
President and Chief Executive Officer

1.1 Profit

OBJECTIVE: To achieve sufficient profit to finance our company growth and to provide the resources we need to achieve our other corporate objectives.

In our economic system, the profit we generate from our operations is the ultimate source of the funds we need to prosper and grow. It is the one absolutely essential measure of our corporate performance over the long term. Only if we continue to meet our profit objective can we achieve our other corporate objectives.

Our long-standing policy has been to reinvest most of our profits and to depend on this reinvestment, plus funds from employee stock purchases and other cash flow items, to finance our growth. This can be achieved if our return on net worth is roughly equal to our sales growth rate. We must strive to reach this goal every year without limiting our efforts to attain our other objectives.

Profits vary from year to year, reflecting changing economic conditions and varying demands for our products. Our needs for capital also vary, and we depend on short-term bank loans to meet those needs when profits or other cash sources are inadequate. However, loans are costly and must be repaid; thus, our objective is to rely on reinvested profits as our main source of capital.

Meeting our profit objective requires that we design and develop each and every product so that it is considered a good value by our customers, yet is priced to include an adequate profit. Maintaining this competitiveness in the marketplace also requires that we perform our manufacturing, marketing and administrative functions as economically as possible.

Profit is not something that can be put off until tomorrow; it must be achieved today. It means that myriad jobs be done correctly and efficiently. The day-to-day performance of each individual adds to — or subtracts from — our profit. Profit is the responsibility of all.

1.2 Customers

> *OBJECTIVE: To provide products and services of the greatest possible value to our customers, thereby gaining and holding their respect and loyalty.*

The success and prosperity of our company will be assured only if we offer our customers superior products that fill real needs and provide lasting value, and that are supported by a wide variety of useful services, both before and after sale.

Our responsibility to the customer begins with product development. Products must be designed to provide superior performance and long, trouble-free service. Once in production, these products must be manufactured at a reasonable cost and with superior workmanship.

A prime objective of our marketing departments is to see that the finished product is backed by prompt, efficient service. Moreover, good communication should be maintained with the customer and among various HP sales teams.

Because of our broad and growing line of products, very often several sales teams will be working with a single customer. Each of these teams has a high degree of technical knowledge and sales skill. There must be considerable cooperation among teams to assure that the products recommended best fulfill the customer's overall, long-term needs.

HP customers must feel that they are dealing with one company with common policies and services, and that our company is genuinely interested in arriving at proper, effective solutions to their problems. Confusion and competition among sales teams must be avoided by a clear assignment of sales responsibilities, plus sound judgment by HP sales people in understanding customer needs and HP objectives.

1.3 Fields of Interest

> *OBJECTIVE: To enter new fields only when the ideas we have, together with our technical, manufacturing and marketing skills, assure that we can make a needed and profitable contribution to the field.*

The original Hewlett-Packard products were electronic measuring instruments. Over the years, our product line has expanded to include computers and computer systems, solid-state components, electronic calculators, medical electronic equipment, and instruments for chemical analysis. Thus our growth has led to a continuing expansion of our fields of interest. To a large extent, diversification has come from applying our resources and skills to fields technically related to our traditional ones.

The key to HP's prospective involvement in new fields is *contribution*. This means providing customers with something new and needed, not just another brand of something they can already buy. To meet this objective, we must continually generate new ideas for better kinds of products. It is essential that before final decision is made to enter a new field, full consideration be given to the associated problems of manufacturing and marketing these products.

1.4 Growth

> *OBJECTIVE: To let our growth be limited only by our profits and our ability to develop and produce technical products that satisfy real customer needs.*

How large should a company become? Some people feel that when it has reached a certain size there is no point in letting it grow further. Others feel that bigness is an objective in itself. We do not believe that large size is important for its own sake; however, for at least two basic reasons, continuous growth is essential for us to achieve our other objectives.

In the first place, we serve a rapidly growing and expanding segment of our technological society. To remain static would be to lose ground. We cannot maintain a position of strength and leadership in our fields without growth.

In the second place, growth is important in order to attract and hold high caliber people. These individuals will align their future only with a company that offers them considerable opportunity for personal progress. Opportunities are greater and more challenging in a growing company.

1.5 Our People

> *OBJECTIVE: To help HP people share in the company's success, which they make possible; to provide job security based on their performance; to recognize their individual achievements; and to help them gain a sense of satisfaction and accomplishment from their work.*

We are proud of the people we have in our organization, their performance, and their attitude toward their jobs and toward the company. The company has been built around the individual, the personal dignity of each, and the recognition of personal achievements.

Relationships within the company depend upon a spirit of cooperation among individuals and groups, and an attitude of trust and understanding on the part of managers toward their people. These relationships will be good only if employees have faith in the motives and integrity of their peers, supervisors and the company itself.

On occasion, situations will arise where people have personal problems which temporarily affect their performance or attitude, and it is important that people in such circumstances be treated with sympathy and understanding while the problems are being resolved.

Job security is an important HP objective. Over the years, the company has achieved a steady growth in employment by consistently developing good new products, and by avoiding the type of contract business that requires hiring many people, then terminating them when the contract expires. The company wants HP people to have stable, long-term careers — dependent, of course, upon satisfactory job performance.

At Hewlett-Packard there are many opportunities for advancement based upon individual initiative, ability and accomplishment. Managers at all levels should be concerned with the proper development of their people and be committed to providing advancement opportunities to everyone, regardless of race, color, creed, sex, age or national origin. Since we try to promote from within whenever possible, people should be given the opportunity — through continuing programs of training and education — to broaden their capabilities and prepare themselves for more responsible jobs.

We want people to enjoy their work at HP and to be proud of their accomplishments. This means we must make sure that each person receives the recognition he or she needs and deserves. In the final analysis, people at all levels determine the character and strength of our company.

1.6 Management

OBJECTIVE: To foster initiative and creativity by allowing the individual great freedom of action in attaining well-defined objectives.

In discussing HP operating policies, we often refer to the concept of "management by objective." By this we mean that, insofar as possible, each individual at each level in the organization should make his or her own plans to achieve company objectives and goals. After receiving supervisory approval, each individual should be given a wide degree of freedom to work within the limitations imposed by these plans, and by our general corporate policies. Finally, each person's performance should be judged on the basis of how well these individually established goals have been achieved.

The successful practice of "management by objective" is a two-way street. Management must be sure that each individual understands the immediate objectives, as well as corporate goals and policies. Thus a primary HP management responsibility is communication and mutual understanding. Conversely, employees must take sufficient interest in their work to want to plan it, to propose new solutions to old problems, to stick their necks out when they have something to contribute. "Management by objective," as opposed to management by directive, offers opportunity for individual freedom and contribution; it also imposes an obligation for everyone to exercise initiative and enthusiasm.

In this atmosphere it is particularly important that the strength of the whole company is kept in mind and that cooperation between individuals and between operating units is vital to our profitable growth.

It is important for everyone to realize there are some policies which must be established and strictly maintained on a corporate-wide basis. We welcome recommendations on these corporate-wide policies from all levels, but we expect adherence to them at all times.

1.7 Citizenship

OBJECTIVE: To honor our obligations to society by being an economic, intellectual and social asset to each nation and each community in which we operate.

All of us should strive to improve the environment in which we live. As a corporation operating in many different communities throughout the world, we must make sure that each of these communities is better for our presence. This means identifying our interests with those of the community; it means applying the highest standards of honesty and integrity to all our relationships with individuals and groups; it means enhancing and protecting the physical environment, building attractive plants and offices of which the community can be proud; it means contributing talent, time and financial support to worthwhile community projects.

Each community has its particular set of social problems. Our company must help to solve these problems. As a major step in this direction, we must strive to provide worthwhile employment opportunities for people of widely different backgrounds. Among other things, this requires positive action to seek out and employ members of disadvantaged groups, and to encourage and guide their progress toward full participation at all position levels.

As citizens of their community, there is much that HP people can and should do to improve it — either working as individuals or through such groups as churches, schools, civic or charitable organizations. In a broader sense, HP's "community" also includes a number of business and professional organizations, such as engineering and scientific societies, whose interests are closely identified with those of the company and its individual employees. These, too, are deserving of our support and participation. In all cases, supervisors should encourage HP people to fulfill their personal goals and aspirations in the community as well as attain their individual objectives within HP.

At a national level, it is essential that the company be a good corporate citizen of each country in which it operates. Moreover, our employees, as individuals, should be encouraged to help in finding solutions to national problems by contributing their knowledge and talents.

The betterment of our society is not a job to be left to a few; it is a responsibility to be shared by all.

Mr. **Lundine**. Thank you both very much.

First, I would like to ask you a question that I would appreciate both of you responding to. Are you concerned about increasingly mechanized or dehumanized offices? I think probably both of you were here today and heard some criticisms and assertions that automation is dehumanizing the office workplace.

Do you share those concerns, or how do you evaluate them?

Mr. **Marshall**. I will be glad to speak first and say we have a concern, and I think because we have overcome the problem to a great degree. The automation you described in terms of laying out an integrated circuit or chip. It could dehumanize perhaps, but here again, if you're bringing these people together, people that work on it, and give them the opportunity to see what they are doing and what it is doing for them, for their understanding of the machine, whatever it is, I think that the dehumanizing influence can go away to a large degree.

We have at our plants right now our PMP program that we talked about, which is a participative program on the part of the employees, where they will ask for automation. If they can see that that will improve their productivity, they will frequently suggest it before the company suggests it to them, because they are closer to the problem and can see it.

I think where the company takes the approach of participation on the part of the employee, to be sure he has an understanding of what he is doing, I don't see the dehumanizing effect taking place. Even in the case of our offices, where we have the same machines that were discussed earlier, we don't see that as a problem or one that we can't overcome.

Mr. **Demere**. The way in which office automation has moved into Hewlett-Packard has also been more at the instigation of the workers than it has at the instigation of management, I believe. Naturally, there is great enthusiasm initially when something new comes in and people get a chance to increase their productivity and play with new gadgets. We have had some concern, maybe after that initial excitement wore off, that there would be some negative effects, but we haven't observed any as yet. We still find that the main things that automation does, it gets rid of the tedious, redundant tasks and allows people more opportunity to do a better job. People generally like to do a better job, and I think as long as we make sure—our belief is that if we automate to improve quality, that we will automatically get increases in productivity, and that by allowing people to do a better quality job, they get a greater satisfaction.

Mr. **Lundine**. How do your officeworkers specifically, if I can concentrate on that area, participate in decisions affecting their workplace and do they have anything to say about the introduction of new technology?

In other words, you just testified that a lot of the ideas come from the officeworker, but suppose that Hewlett-Packard or Motorola management decides "we are thinking of or we're going to introduce a new office technology". Is there a consultation process and how does it occur?

Mr. Demere first.

Mr. DEMERE. We haven't, as far as I can remember, had any kind of broad scale office technology improvements. They have been more individual departments, and where that has happened the people have certainly been involved in the decision. They have often tried out a number of different types of equipment and been involved in the choice of the equipment they have ended up with.

Mr. LUNDINE. Describe this participation and how it occurs. Do people meet with their boss, or by department, or is it sort of a diagonal slice where you get different people from different levels of the organization but it may not be with their immediate supervisor?

Mr. DEMERE. Well, there are several different ways. Oftentimes in the case of a secretary, for example, it will be just through his or her own initiative, working with his or her boss or working with some of the other secretaries.

One of the things that we have used extensively at Hewlett-Packard in the last few years was the Japanese idea of quality circles. We call them quality teams. In the department in which I work, for example, the secretaries there have a quality team. Our department has several hundred people, so there are a number of secretaries. Some of them have gotten together and formed a quality team and they are coming up with ideas themselves on ways that they would like to see their work automated.

Mr. LUNDINE. How do the PMP teams work at Motorola?

Mr. MARSHALL. In the offices we have just in the last year or so been putting them into offices—something we have been doing for years in the factories or in the production areas. But there is, as he described—particularly you get job groups that are similar together. There is a regular meeting, in most cases a once-a-week meeting, where they will talk about whatever problems they may have in getting the job done and how to improve it.

You mentioned the word processor. There I think when it was first introduced in our office here in Washington it was due to the fact they had heard about it in other offices and they asked for it. So they got it. Now each one wants a terminal for the word processor so they can have more easy access to this.

What you will find in this thing, too, is not only the productivity but the quality of the letter being turned out is much better. We talk about quality of product being important of a semiconductor we may produce, and you will find even the same thing is taking place for the letter. It will look better and it will be better when it comes out as a result of these people working together and taking pride in it and an understanding of what can be done to improve it.

We are going into a computer system now so that we can tie our not only word processors but other data information from our office to other parts of the company. In the case of the word processor, that is one where something can be run out on a word processor either here or in Phoenix, Ariz., and then, of course, tied together so that one word processor can talk to another. That is something that originated at the secretarial level, this capability.

I think that our formally doing it, just by a regular meeting, discussing the common goals and objectives when people get together, it has been the key item, plus an incentive for when goals are bettered there is a financial reward. By the way, in our case that can be up to 40 percent of base salary.

Mr. **Lundine**. Mrs. Heckler.

Mrs. **Heckler**. Thank you, Mr. Chairman.

I will say I am delighted to hear you both, and I have to say to Mr. Marshall that you have made the subject of the hearings a very personal issue. It was earlier a fairly academic exercise. But I personally have visited your plant many, many times, as you know.

Earlier Dr. Driscoll talked about the need to have workers have a veto power over the introduction of new equipment. What do you think of that idea?

Mr. **Marshall**. I think that if the workers didn't want something, we would certainly listen very, very carefully. The odds are there would be a reason we wouldn't do it. But we have never used the term "veto power". There have been times when they have come back and said "we don't think it's a good idea, and here are the reasons why" and those things have not been done, if their reasons were good. Somebody has to have the best answer to it. The manager or the management may come back and give even more reasons why it should be done.

In every case there has to be a rationale, no matter which group of people comes up with saying they want it or don't want it. They have a rationale for it. The winning rationale may be on the part of the work group or it may be on the part of the management. But we don't use the term "veto power".

Mrs. **Heckler**. Well, the term is a harsh one, but at the same time I think he was referring to the lack of any type of involvement on the part of the workers. The practicality of having the workers make these decisions is, I think, an open question.

Mr. **Marshall**. Well, we have not taken certain actions after the workers have looked at something, or even tried it, who came back and said "here's why we don't think it is the right way to go." We have done that on many occasions. You're closer to this than I am, where they might come back and——

Mrs. **Heckler**. Is that your experience, also?

Mr. **Demere**. The experience that we have is that we find—first of all, our policy is to encourage decisions to be made at the lowest possible level, where the knowledge is available. We generally feel that the people closest to the work are the ones that know most about it.

If you want to encourage them to do something that is a little different and maybe threatening to them, it is like anything else in life, you have to sell it, whether you're a politician or a manager or whatever. Sometimes you have to sell. And if you don't make the sale, then you back off. And sometimes to move ahead, you have to try a different approach. Oftentimes this will involve new training on the part of the person, if it is something that is drastically different.

But I think we have great respect for the individual and people doing the work, and unless you feel very strongly that something will be better and you want to make the sale, then you have to back off. But I think consensus management is something that we practice not only among the management but throughout the company. So we try and do everything with a lot of teamwork.

Mrs. HECKLER. Dr. Driscoll also said that there is no proof that the automation in office technology has actually increased productivity. Would you say he was correct in that?

Mr. DEMERE. I feel we have lots of proof. I can't quote you any numbers, except in the one case I talked about in the manufacturing engineering department, where we reduced the number of people from 22 to 17, and they enjoyed their work a lot more. They got rid of some of the tedious elements of it and we reduced the floor space by more than half.

I don't have numbers on the added equipment, but the value of the equipment that we added was not more than probably $25 or $30,000. So overall, just based on those numbers, the productivity improvement in that particular case was quite significant.

Mrs. HECKLER. Very substantial.

Has that been your experience?

Mr. MARSHALL. Yes. I would say certain office equipment has improved productivity. I would also say, no matter where we end up using it, we haven't cut any people. We have ended up turning out more things or doing a better job of what had been done in the past. We are in the process now of computerizing something we deal with, the FCC licensing information for our customers. We have about 15 people who work in this area with cardex cards that they have been using. If they go over to the computer, we will still have the same number of people but will be supplying the field with about five or six times as much information. So I don't have any examples that I can relate to that have changed the number of people. It has just improved the output so much.

Mrs. HECKLER. We are very satisfied with your growth and the number of people employed at your plant in my district in Massachusetts, I want you to know that I have not personally discerned any lack of motivation or lack of productivity. I don't think it would be tolerated. I think also that the workers are quite proud of the work that they put out in the Codex plant in Mansfield.

Mr. MARSHALL. We certainly feel that. We are pleased with the workmanship in the Massachusetts plant and the productivity of it.

I think the growth of that plant in a very high technology area, and one in which the jobs are changing constantly because of this, that in conversations with these people you will find they are not turned off by this but inspired.

Mrs. HECKLER. Throughout these hearings many witnesses have said that the technological or innovative growth has far outdistanced our understanding of the social or human ability to adapt to that growth. At the same time I see enormous changes in the workplace in terms of the involvement of workers, who for the first time are being asked to make decisions.

Would you say that still, overall, let's say in the high technology industry, where there is such innovative growth, that we are lagging in terms of really mastering the social element, the social adaptability question of man's comfortable relationship with technology?

Mr. MARSHALL. I know we are not where we would like to be is probably the answer to your question. We are constantly trying to improve this and make it more encompassing so that the employee can be a greater part of it.

I think that need is greater today than it was certainly 100 years ago, before we had technology as an item to contend with. But I know in the Motorola program we are going in this area and we would expect it to be, within 2 years from now, probably double in its effectiveness versus where it is today. We are just putting that much effort into it. The responsiveness on the part of the employee has encouraged us to continue to do that.

Mrs. **Heckler**. Of course, it would seem to me to be simply good business to consult with employees who know the machinery they deal with and the capabilities of it. If you have faith in the employees, then you are going to have some faith in their judgment as to how effective and more productive the machinery or the equipment in which you're going to invest will be in a specific work situation. So that communication only serves the interests of the companies.

I want to know, is there any Japanese influence in this whole thing? I hear from my high-technology friends what Japan is doing and all about the Japanese industrial climate, the workplace climate, the human relations, and the differences between the two countries.

Has the Japanese system influenced a change in thinking in American industry?

Mr. **Marshall**. It certainly has.

Mrs. **Heckler**. In terms of employee relations as well?

Mr. **Marshall**. I think that some of the things we are doing we started doing before the Japanese challenge was a challenge. But it has certainly motivated us to look at these things more closely, because some of the things they do in their employee relations are the things we are talking about right now, and they have done them very well. Certainly they have turned out a good product, certainly not a better product, and not necessarily more productive itself. But I think when you have any competitor—if you don't have a competitor, you aren't as likely to do any of the things we are talking about. U.S. competitors motivate us to take action, too, and the Japanese are another form of competition and very tough competitors, no question about it.

Mr. **Demere**. I feel the main thing we have learned from the Japanese is their rabid concern for quality, and that has made the biggest difference. I feel that in terms of their culture and their style of working with people that it meshes very well with the style that we have had at Hewlett-Packard always.

The thing we picked up from them, I believe, is the quality circle idea, which is kind of a way of formalizing what we consider our HP way of working with people on a teamwork basis anyhow. I guess we have brought back to the United States some of the ideas that they learned from Drs. Juran and Deming about statistical quality control and other things which we haven't used as extensively in the past but are putting in more now, which are added tools for workers.

One of the things that we have been pleased to find is that the first line workers are able to pick up some of these statistical quality control techniques and use them very efficiently. So the Japanese have definitely been a positive influence in that regard.

Mr. **Marshall**. I would assume the Japanese were discussing their problem 20 years ago, or 25 years ago. They would have said the worst problem they have is the quality image, going back years ago.

Mr. **Demere**. Yes.

Mr. **Marshall**. Right after World War II they were not associated with quality, and I think they put such an effort into solving that problem that they did teach the world a lot in that regard, the necessity for quality. That's not all bad. The manufacturers not only in Japan but certainly the United States or in Europe will undoubtedly pay more attention to quality because of the competitiveness of the business.

Mrs. **Heckler**. I suppose one of the indicators of employee satisfaction or dissatisfaction would be the turnover rate. Is there a high turnover rate at Motorola?

Mr. **Marshall**. Our turnover rate would probably be slightly lower than it is in the industry that we are in. Overall, we would not consider it a high turnover. I think the electronics industry is not noticable for high turnover, although certain parts of it have had very serious ups and downs——

Mr. **Lundine**. Would you yield?

Mrs. **Heckler**. Yes, I will yield.

Mr. **Lundine**. You have an operation in the so-called Silicon Valley; is that not correct?

Mr. **Marshall**. No, we don't. We have a very minor, small operation in California, but our principal semiconductor plants are in Arizona and Texas rather than Silicon Valley, although Arizona is becoming sort of a Silicon Valley of its own in the last few years.

Mr. **Lundine**. Have you in those locations had any extraordinary problem with turnover of professional and engineering as well as production people?

Mr. **Marshall**. Engineers are in great demand. The supply does not fill the need, and I would say in the engineering area there has been turnover in the last few years that was greater than we have had in previous years. I think that is due to a great degree to the supply not meeting the demand, and I also think some of it is perhaps wanting to have somebody that is already trained and knowledgeable, et cetera, in particular fields. I think it is largely the supply-demand situation, and the fact particularly during the wage price controls where engineers were leaving because that is the only way they could get a raise, and they knew very well they could get it by going somewhere else.

Mr. **Demere**. I would say in general that our turnover rate is less than 10 percent on a nationwide basis. We, I am pleased to say, have never had a layoff. We have never laid off anyone because of a work slowdown. That is one of our basic policies, to try not to take on more work than we can maintain the work force for.

Mrs. **Heckler**. I would just like to ask one other question, Mr. Chairman. I don't want to prolong this.

I would be interested in how the quality circle concept actually operates in a single plant. Do you select out, or do people volunteer to be among those who are the members of a panel, for example? How are they chosen and how does the system actually operate?

Mr. **Marshall**. The way we do it, we will take a production line, let's say, within the plant, or the people who are working on a related item, and they form the quality circle. All the people involved will be—we don't call it quality circle——

Mrs. **Heckler**. Don't you have almost hundreds of people——

Mr. **Marshall**. No, we break it down into much smaller groups. The groups may be 15 or 20. They might relate to another group of that size, but we have relatively small groups, so that they feel part of something small.

Literally, we have had a profitsharing program since the 1940's that is companywide, based upon company overall profits, and it is an effective motivator. But when you get it down to where they recognize their own work and relate to it, then it becomes more a part of them. This is what we are doing now. It is like profitsharing in the sense that if the group can get together and save money, they feel the results of that. When you get the group small enough, they see the results of their own efforts.

Mrs. **Heckler**. Do they get any recognition for this?

Mr. **Marshall**. Money.

Mrs. **Heckler**. Oh, there's a special bonus?

Mr. **Marshall**. Oh, yes, up to 40 percent of their salary.

Mrs. **Heckler**. And how often is this actually implemented?

Mr. **Marshall**. Quarterly it is paid.

Mrs. **Heckler**. Is this based on a unit? For example, if you worked in——

Mr. **Marshall**. The goals are set by the group itself and rarely—let's say not often changed by management. The goal doesn't exist unless it is agreed to by the group itself. They set their goal of what it is they want to accomplish, what it is they want to improve.

Mrs. **Heckler**. If they express extreme dissention or negativism about a specific approach or specific goal, is that significant?

Mr. **Marshall**. It would usually get changed.

It is amazing that they usually are going to have an interest that is tied into the company's interest when they are arriving at this conclusion of what it is they think they should be doing.

Mrs. **Heckler**. Is this true of the office staff as well?

Mr. **Marshall**. In the office staff, yes. It is more difficult in the office staff. We have not adopted it universally as easily as we can in the production facilities, because finding enough people to work together on a common project is more difficult. But we are doing it where we can. We don't know the answer as to how to get it down to the office where there are three people, for example. Some of our small offices out in the field have very small staffs. But we eventually want every employee in the company to be part of this program, everyone that is not on some other form of bonus, so that everybody would have to be in the program—or salesmen, let's say, on a commission on this arrangement would not be in this program.

Mr. **Demere**. Our program is a little different. We have about 550 quality teams within the company, and they range anywhere in size from 3 people up to a dozen or 15. They are voluntary groups. We have, I believe, between 30 and 40 percent of them are in nonmanufacturing areas. They are in the office administration areas; they are in the field sales areas, field offices as well as division offices. There is no direct compensation bonus to the individual or to the members of that team. Their incentive is to do a better job and share in the overall bonus with everyone in the company, which is equal.

We have had some teams for as long as 4 or 5 years, and we have found they have been very productive. A lot of them have, as I say, incorporated statistical quality control techniques, so they have actually analyzed some of the work that they do and they have determined whether or not it was in control, and if it wasn't in control they tried to get it in control, and then they would analyze which were the major things that prevented them from doing a better job and try to improve those operations. We found it to be very beneficial.

Mrs. HECKLER. Say a team really objected to the introduction of some equipment, or felt there would be a very negative fallout among the employees' morale or health or simply contribute to a nonproductive attitude among the employees. Say, at the same time, management felt that, after reading a great deal about it, the technology would be effective. How would these issues be resolved?

Mr. DEMERE. It is hard to answer that question because we haven't had that kind of circumstance, because the quality teams work in such a manner that they come up with the ideas and they usually have enough control over the situation to put those into place themselves. That is the basic idea of the quality control teams, is that the people can work on things on which they can have some impact.

Mrs. HECKLER. It would seem to me that there might be a real difference between assembly line work and office work, where productivity is so easily measured in the number of items that are produced by the assembly line, the quality is also inspected, and so forth——

Mr. MARSHALL. It changes your method, what you account for. On a production line you have always accounted for the cost of the goods, whereas in the office you have not.

Mrs. HECKLER. And, of course, the number of defects in the product come back to haunt you.

Mr. MARSHALL. You put some disciplines on the office and the measurement tool would be quite different from the factory.

Let me add one comment that I think is relevant—or impressive at least—and that is the fact that in cases where we have put this plan into effect, versus a plant where it is not in effect, that in almost every case—in fact, I think it is in every case—the employees have set considerably higher goals for themselves than management has previously, or in the existing plant where the program does not exist, that the employees' goals are higher than management had set for them.

They are also more aggressive about getting the innovative machinery or whatever it may be, and that is what we find. As you say, you have not had the problem that it has been rejected, and I don't know of any problem that we have, either. If the employees said it is wrong, we would certainly listen and probably assume that it was wrong.

Mrs. HECKLER. Thank you.

Mr. LUNDINE. Mr. Marshall, is your PMP system or structure used in union as well as nonunion operations?

Mr. MARSHALL. We don't have unions.

Mr. LUNDINE. Nowhere in your company?

Mr. MARSHALL. No, we don't.

Mr. LUNDINE. On page 4 of your testimony, you just touched briefly on the criticism of American management being too short-term oriented. Do you think that is a valid criticism, or a concern—let's put it that way—and if so, what could we do about it?

Mr. MARSHALL. I certainly think it is something that we have had a lot of self-flagellation in the last year or so, vis-a-vis the Japanese. I think that there are, of course, U.S. managers who are short term, looking at only what is going to affect this month's P. & L. statement. I think the corporation overall has to take a look and say we're in business to be here 10 years from now and therefore inspire amongst its managers that they cannot look just at the real short term.

It is true to some degree, when it comes to the need for profits, the need to show a percentage of profit, that in the United States our standards are different from those of Japan. I don't know that we should change our standards or anything just to agree with Japan, unless we know that it is an improvement. I don't know that their system in that regard is any better than ours. As Mr. Demere spoke of quality, certainly that is something that has inspired greater quality here. But so far as the method of management, I think the participative management that they have gone farther with than many U.S. companies have is something that will bring about through example a lot more of that in the United States.

We, too, have been at it for many years in a participative program, but so far as the managers themselves, looking at the short term, this participative program, of course, does not solve that problem except that the manager begins to see and feel some of the things coming from those people which do frequently give him a longer term look.

Mr. LUNDINE. I was interested also, Mr. Marshall, in your testimony about your electronic technician training program in Fort Lauderdale. Of course, I was particularly interested in the fact that you used the CETA program to help with that training.

It brings to mind the question of what you think the Government role is in meeting training or retraining needs, and I guess one specific question about your Fort Lauderdale situation is will the cutbacks in CETA have any impact on it?

Mr. MARSHALL. So far as I know, they won't. This program is one of the programs that is looked at as being successful—in fact, we are planning to use it in three other places. It is a program where Motorola puts up a fair amount of money also for employees that are not working for us at the time. The particular program we are in, the employee goes to school, an electronics technician school, and CETA pays the tuition and the minimum wage, I believe it is. We pay the difference between the minimum wage and the normal wage, which is frequently a greater amount than the Government is paying, while he or she is in school getting their training.

Is it something that industry should do on its own, you know, is a question. We are certainly considering that, although I believe that CETA did get us started down the road in an area that we think is—it was a program that existed and we decided to use it and found it a very effective thing.

It also meant more employees coming in to replace the ones that were going to school, and they were the ones that had a certain CETA qualification or requirement. But so far, that particular program has not been affected by the cut in funds. It could be, but I believe, as things stand at the moment, it won't.

Mr. **Lundine**. Mr. Demere, without being excessively——

Mr. **Marshall**. In other words, there is no guarantee that individual will come back to Motorola, either. You are making an investment in his education that may or may not pay off. But in most cases, they have come back.

Mr. **Lundine**. It is fascinating. I had to follow up a little bit because it is so much needed in this country and I have some concerns whether the Congress under this administration is going to continue those worthwhile efforts such as yours.

Mr. Demere, you have told us about Hewlett-Packard's philosophy of lifetime employment. I am interested in your observations of how important you think that it is and has been to your own productivity.

But you have also told us about a whole range of philosophies that are just fascinating, and at least from critical testimony we have heard, probably not shared by a lot of U.S. corporations. Of course, some of them probably aren't in growth industries such as you are and thus do not have the luxury that you do in some regards.

But the first question I have is what relationships specifically do you think the job security philosophy you have has on your own success or productivity, and second, how do we get more companies to take the kind of philosophy that you have?

Mr. **Demere**. First of all, I think that the employees have confidence that if their particular job is displaced, that they will have an equal or hopefully, better job, within the company, and that the company will protect them in that sense.

Of course, we have not only the job security which helps that, but we also have, as you mentioned, the fact that we are a growing company and we are adding new people right along, so there are new opportunities opening up right along.

Another thing that we are very strong about is growth from within. We bring in very few people from outside of the company at management levels. We have been very strong on growing our own managers. We generally bring people in out of school and they stay with the company. We encourage them to stay a long time. So I think this gives a lot of security as well to people in the management ranks, because they don't feel that people will be brought in on top from outside, that we only have basically people from within the company to work with as they go along.

As to how we might get to other companies and help them more, I am sure it is very difficult in areas where you do not have a growth industry. I guess there you have to use a kind of long-term approach to your business. We decided a long time ago that we did not want to take, for example, large Government contracts for electronic equipment, which would mean we would have to hire a lot of people which we might not have permanent jobs for in the long run. So we purposely build very cautiously and we are always practicing real-time management. So as soon as we anticipate any kind of a turndown in our business, we slow down on hiring or stop hiring and cut back early in terms of our growth so that we don't overshoot, for example.

Mr. **Lundine**. Are you cutting back or hiring right now? [Laughter.]

Mr. **Demere**. I would say at the moment hiring is moving ahead, but slowly.

Mr. **Lundine**. That was a question somewhat in jest.

Mr. **Demere**. We are a little concerned about the double dip. It looks like we may be into the second dip.

I do think it is a matter of—first of all, if the company is an innovative company in itself, and its management is innovative, they are going to come up with ideas that will help the company grow, regardless of what business you're in. There is growth in the steel business, there is growth in all kinds of the old, prosaic kinds of businesses. I think it is a matter of having enlightened management, and then it is also a matter of just selecting good people to start with and they will help you. If you select good people, they will help the whole company reach its objectives and do a better job and be in a better competitive position.

Mr. **Lundine**. Finally, I only have one other question. I think during the testimony of one of you, but regardless whether that is accurate or not, a comment was made about the adversary relationship or attitudes. Particularly I am interested in the adversarial attitude between business and Government. It goes over a fairly long period of time, with different parties in power, and a wide range of industries.

We have had some foreign witnesses seeming to indicate that there is a greater degree of collaboration between business and Government, as well as between labor and business, in other places.

Do you have any general observations? Are you concerned about the lack of cooperation or strategy between business and Government and what you think might be done about it?

Mr. **Demere**. Yes. I feel that, in general, we don't communicate enough. Just like we are finding with some of our vendors that I mentioned in my written statement, we don't understand enough about their manufacturing process and they don't understand enough about our application.

I think in the political world that business fails to make people in the Government fully aware of what their problems are, and we don't try to understand the problems of people in the Government enough. So I think the whole problem is communication.

I feel that in this country—for example, if we compare to the Japanese, the Japanese by culture are more concerned about their duty to others, be it family or their business or their Government. We in this country are more looking out for No. 1. We are more concerned about our rights than we are about our duty to others. So I think that is one basic difference, and I am not sure that that is good or bad.

Sometimes our individual aggressiveness can be very good, as it has shown in the past. But I feel there is too much concern in our country for individual rights and so forth. I think we need to pull together a little bit as a country in terms of a long-term future, and that in the various segments we need more communication, for example, between business and Government so that we understand each other's problems much better and can make sure that when laws are passed that they are meaningful, that they do the job they are supposed to do, in helping all elements of our society.

Mr. LUNDINE. How can we get that better communication?

Mr. DEMERE. Well, in the last 10 or 15 years in our company we have tried to make a greater effort, to encourage all of our managers and our people to get out and get to know their people in Government better in each of the areas in which we operate.

It is hard to say how we can do it on an overall basis. I think meetings like this, hopefully, will help. But that is a pretty small tip of the iceberg.

Mr. LUNDINE. Do you want to make a comment?

Mr. MARSHALL. I will make one comment. I would certainly agree with everything that has been said. I think communications is the root problem. I would add I would not want to see us do some of the things that the Japanese do between Government and industry, but I think communications is very important.

We have started a program that we believe will be effective of inviting Members of Congress to visit our facilities and hold what we call a Town Hall Meeting, either in the cafeteria, or if there is an auditorium in that facility, we use that. And where the plant has more than one district, it would be just his constituents, or her's, in that particular session. So there can be an exchange between the people and the Member of Congress.

Also at those same sessions we have not only management, but down to the production employee. We have tried it two or three ways and the most successful is this one, of bringing them all together and then letting the comments come, whatever they may be.

Now, I think that has brought out a lot regarding the business. True, many of the questions and comments from the employee might have to do with the tax bill or something rather than something to do with the business, but a third of those questions will have something to do with their job or their employment or the business they are in. Now, what the long-term effect of that would be—we would like to see a lot of companies do the same thing, so that there would be more of this interchange. But we have been doing this for a little over a year, and where it has been done the employees and management feel as though they are communicating. Not all of our management comes to Washington to talk to Congress, but only a fraction would do that. But they feel a great satisfaction.

Those Members of Congress that have done it have all said they felt they had communicated and learned something from it, and I believe they are telling us the——

Mr. LUNDINE. What about State and local officials; have you ever tried it with them?

Mr. MARSHALL. Yes, we have, and particularly where——

Mr. LUNDINE. That's where the growth is going to occur.

Mr. **Marshall**. That gets into everything from roads leading to the plant to, in Phoenix, where the bridge frequently gets flooded and we can't get to work, then that sort of thing comes up. But the Government official will know that coming in—in fact, we will usually tell him some of the sort of things we think he might be subjected to. The local official will have a far worse time than a Federal official would, because there you get into the nitty-gritty of their daily lives.

Mr. **Lundine**. I know. I'm a former mayor and understand that.

Mrs. **Heckler**. Will you yield?

I would just like to say that we in Government have a responsibility here, too. I have been meeting with a group of business leaders in my district, and I have been meeting for many years with labor leaders. The business leaders until now were not interested in that kind of exchange.

I have to say that one of the most unfailing attendees at any of our sessions is Arthur Carr, who is the president of Codex, which is a subsidiary of Motorola.

Mr. **Marshall**. Yes, he is very enthusiastic about that.

Mrs. **Heckler**. This exchange has been very productive, and his point of view has expressed a tremendous concern for the workers, who are my concern in the district.

Now, I have found him particularly faithful and resourceful in his comments. I frankly think that if this type of exchange were set up with Members across the country, with business leaders, labor leaders and workers, that we would have a really productive union with a sharing of interests. We would find the bottom line in order to form a consensus. But I have to give Motorola high marks for that particular operation and, for that particular leader in charge of the plant, because I also see a tremendous sensitivity to the workers' attitudes, needs, points of view. This really is thoughtful sensitivity shown by the leadership of the company—and it's a massive company.

Yet I am personally very concerned about not only the latest level of productivity, but also how the workers are faring, what their quality of life is and what their attitudes are. So I frankly feel that not every company has this public-spirited kind of leadership that we do in that company with which I am obviously very, very familiar. I think maybe this is the new breed of leadership in American industry and it would perhaps be very useful for the whole country.

I think we in Government have a role to play and we cannot remain aloof in Washington. It is up to us to go back to the districts and go to all of our companies and remain available to them.

I thank Mr. Marshall for Mr. Carr.

Mr. **Lundine**. I want to thank you both for your testimony. My colleague, Mrs. Heckler, just used the word "leadership." Indeed, yours are two organizations and obviously you are two individuals who are providing great leadership. We appreciate the contributions you have made to these hearings very much. Thank you.

[Whereupon, at 12:30 p.m., the subcommittee was adjourned.]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

THURSDAY, SEPTEMBER 17, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:10 a.m., in room 2325, Rayburn House Office Building, Hon. Stanley N. Lundine presiding.

Mr. Lundine. This hearing of the Science, Research, and Technology Subcommittee will come to order.

This morning we are concluding 6 days of hearings on the subject of the human factor in innovation and productivity.

Prior to hearing from the witnesses I'd like to ask unanimous consent that a statement of the General Motors Corp. on improving quality of working life, which has been previously submitted to the Committee on Post Office and Civil Service, be made a part of this record. Also without objection any questions on the subject of General Motors' quality of working life program would be answered in writing, should any of the members of this subcommittee have such questions about their quality of working life program.

[The information follows:]

Statement

of

General Motors Corporation

on

Improving the Quality of Work Life

Submitted

to the

House of Representatives

Committee on Post Office and Civil Service

Subcommittee on Civil Service

Washington, D.C.

June 23, 1981

General Motors appreciates this opportunity to discuss its efforts to improve organizational effectiveness and enhance the quality of life at work.

H.R. 3116, the bill under consideration, seeks to improve the efficiency of Federal agencies. Importantly, it recognizes the link between organizational effectiveness and employes' quality of work life (QWL).

The QWL movement is at least a recognition of, if not a result of, the changes in the workforce. As Columbia University Professor Daniel Yankelovich put it, workers today are a "new breed".

This is not really surprising. The workforce merely reflects what is happening in society -- and today's society is characterized by changing attitudes, the questioning of traditional values and higher expectations of our institutions and organizations.

But change is inevitable, and we must revitalize our institutions and organizations to respond to it. We are beginning to learn how to bring about greater compatibility between the attitudes, values and expectations of people and the institutions and organizations which exist to help fulfill the needs of society.

In General Motors today there is a wide range of activities under way to assure our responsiveness to the needs and aspirations of our employes. We have a deep concern for the personal well-being of our employes as well as for our success as an organization. We are confident the well-being of our employes is inseparable from our effectiveness as a business.

We are now years into the development of a comprehensive and ongoing improvement process based on the compatibility of our business objectives and the reasonable expectations of our employes. Underlying our course of action is a belief that the maintenance of a work environment contributing to personal dignity and self-respect is one dimension of the process of organizational effectiveness.

This belief has found support in a long series of studies and projects which have led to a concerted effort in General Motors to enhance the quality of work life.

Three key approaches have emerged and continue to be pursued simultaneously as a result of the knowledge and experience gained to date. These are:

- Employe-management cooperation, with particular emphasis on union-management cooperation where the employes are represented by a union for collective bargaining purposes;
- Innovations in the workplace; and
- Measurement.

These and other sub-approaches and structures used in General Motors all have a similar desired outcome: they facilitate greater integration of information, knowledge and people across traditional boundaries in order to improve the quality of the decision-making process and, hence, the quality of decisions and performance.

Employe-management cooperation is an essential part of any effort to improve the working relationship. There must be a development of mutual trust. There must also be a mutual respect for both the needs of the business and the employes. Above all else, the cooperation must be mutual and sincere.

In 1973, General Motors and the United Automobile Workers Union (UAW) established the GM-UAW National Committee to Improve the Quality of Work Life. The committee constitutes a system parallel to, but separate from, the traditional collective bargaining process and is used by management and the union to identify and cooperate on issues that affect the quality of work life of the employe.

This committee is composed of high level corporate and UAW executives who meet regularly to consider joint projects and to review and evaluate those already underway. Another of the key functions is to encourage the diffusion of management and union collaboration in both General Motors and the union organizations.

At present, more than 90 locations have established joint union and management projects aimed at enhancing the quality of working life.

The second key approach, workplace innovations, relates to the actual application of QWL principles. In this regard, it is important to note that General Motors maintains a flexible approach. Each of our organizations -- whether a small group or an entire division with thousands of workers -- may develop the QWL activities best suited to its present and future needs and goals.

One thing is commonly emphasized, however, and that is communication. This means face-to-face communication, flowing from employes to supervisors as well as the other way around.

As can be imagined, this flexible stance has led to a variety of workplace innovations. One successful activity which also holds great promise for the future is that of plant design.

A comprehensive planning process is being used to design new plants and to convert plants so that human as well as business needs are recognized. Organizational elements such as job content, work group structures, plant layout, reporting relationships and the reward system are designed to be consistent with an organizational philosophy that is both task- and people-oriented.

Similar principles are being applied to existing converted facilities. In April, for example, Buick Motor Division and the UAW announced the completion of the Factory 81 program.

Factory 81 is the result of a cooperative effort by Buick management and UAW Local 599 to develop an innovative way to run a renovated plant in Flint, Michigan. When its foundry operation was phased out last summer, Buick was able to obtain a new product operation to fill the manufacturing space.

The new operation required complete renovation of the existing structure and the installation of modern and highly automated manufacturing equipment.

Local management and union officials took advantage of the opportunity presented by the new operation to further the QWL objectives they had been actively pursuing for several years. They met for many months prior to plant start-up to develop innovative ways of running the new operation. A joint design team was formed to plan the social and technical aspects of the new plant. Production began only after months of detailed planning and employe orientation. Among the changes differing from traditional systems are:

- work units -- production employes are divided into groups of between 3 to 14 employes, with each unit performing all the work in its part of the process and electing its own leader;

- product areas -- the plant has been basically divided into areas that produce some component of the finished product. There are also support product areas such as central housekeeping and material control. Several work units operate within a product area and they include all workers in that area;
- quality operators -- all hourly workers, other than skilled trades, share this classification. There are no title distinctions such as those which previously indicated different job functions (for example, assembler, sweeper or inspector);
- pay for knowledge -- workers have the opportunity to increase their wages based mainly on ambition, ability and knowledge. Job criteria are established by the work units. Raises are given when a worker has met the criteria for performing all jobs within the work unit; and
- time clocks -- Factory 81 has no time clocks; everyone is on an honor system.

Another effective innovation in the workplace is the Employe Participation Group (EPG), involving concepts similar to those of the Quality Control circle.

An EPG is a small work group of from 8 - 12 employes, including a supervisor. It meets voluntarily -- whether in the plant or in the office -- to identify and solve problems in its own work area. The problems worked on range from safety and product quality to work procedures and attendance.

EPGs operate on the premise that the workers are in the best position to provide meaningful ideas for improvement in their own work areas.

EPGs have directly contributed to cost savings, improved quality, improved communications, reduced absenteeism and fewer employe complaints. Such improvements are the result of involving employes in the problem-solving and decision-making process. An equally important benefit of this involvement is the enhancement of employe pride.

A number of our locations have implemented Employe Participation Groups since 1977. Among them, for example, are the Grand Rapids, Michigan operations of the Rochester Products Division (formerly Diesel Equipment Division) with nearly 70 EPGs currently; and Buick Motor Division with approximately 200 of these groups in operation.

The third important approach in our quality of work life experience was the development of a comprehensive survey to measure how our employes feel about their working climate, while keeping their views anonymous.

This Quality of Work Life Survey, introduced in 1976, assesses employes' feelings regarding 16 different dimensions of work life such as the physical work environment, economic well-being, development and utilization of employe skills and abilities, employe involvement and influence, and work group relationships.

Our policy is to offer salaried employes the opportunity to take the survey at least once every two years. Management and union officials at respective locations jointly decide whether to offer hourly workers the opportunity to take the survey.

Each organization within GM that uses the survey receives the results for each item on the questionnaire, a separate score for each of the dimensions, an overall quality of work life index and a comparison with corporate norms. As previously mentioned, there is no way of linking the results with individuals -- only with the group.

Many units use the surveys as a springboard for involving more of their people in identifying problems and developing solutions. In addition, at the corporate, divisional and plant levels, the QWL Survey has become an important part of the long-range improvement process in which opportunities are identified from the survey, changes are planned and progress toward goals is monitored through future surveys.

In our years of effort to enhance the quality of our employes' work life, we have been able to infer certain principles. They are:

- there is no best way to design an organization. Organizations should be structured based on the principles and goals vital to those responsible for making them perform and become successful;
- in designing and redesigning organizations, we should attempt to create proper balance between the technical and social systems. If too much emphasis is placed on either of these systems, the other will suffer. For example, if we can design organizations that are the ideal of technological sophistication, but we cannot get people to work or perform effectively in them, the technology is unlikely to achieve its maximum level of productivity;
- people support that which they help to create. It is vital, for example, that the users of new technology be actively involved in helping to understand the nature of that technology and how best to assimilate it into the organization;

- organizations, like individuals, must have integrity. An organization must be founded on principles and goals relevant to its reason for being and adhere to them. If the behavior of an organization belies its founding principles, employes will lose confidence in its integrity. Organizational disarray and reduced performance will occur;
- the quality of the outcome of any system is a direct function of the quality of the system itself. Since we cannot manage the outcome of a system, we must concentrate on managing the variables that produce the outcome;
- as we shift from labor-based to knowledge-based organizations, it has become increasingly apparent that rigid traditional organizational structures impair rather than facilitate sound problem identification and resolution. Yet, the expertise for resolving critical issues is generally somewhere within a large organization. We must continue to experiment with structures that will help to identify, integrate, and reinforce the unique decision-making capabilities in the workforce;
- in order to create more competitive organizations, it is essential that we have a clear understanding of what the principles and goals of future organizations must be. Upon establishment and communication of those goals and principles, it is vital that we create and nurture the organizational tools that will transform them into operating practices.

We are proud of the accomplishments we have made so far. We also know there is much room for further improvement. The very nature of the quality of work life concept demands that we continue to question whether people are being given the opportunity to make full use of their talents and abilities, not only for their own satisfaction but also for the good of our organization.

The concepts we are applying are not at all complicated. Treating employes fairly, recognizing their rights as individuals, encouraging more involvement of employes in decision making, providing reward and recognition, establishing opportunities for personal growth and development...these are some of the basics of our quality of work life effort.

If we are to continue to improve harmony and compatibility and to provide a work environment responsive to social change, then we must continue to evaluate our institutions and organizations on the basis of such principles.

The task is not easy, but our experience indicates that systems can be developed and managed in such a way that people can contribute more significantly to organizational objectives, that our human resources can be used better and that the working lives of men and women can be enriched.

* * * *

Mr. **Lundine**. This morning initially I am delighted to welcome our colleague and member of this subcommittee, Merv Dymally from California, and I will ask you to proceed and perhaps you can introduce your colleagues. Although we have a witness list maybe you can do that.

STATEMENT OF HON. MERVYN M. DYMALLY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA, ACCOMPANIED BY WILLIAM GREENE, CHAIRMAN, SENATE INDUSTRIAL RELATIONS COMMITTEE, STATE OF CALIFORNIA; BEN MUNGER, STAFF ECONOMIST FOR SENATE INDUSTRIAL RELATIONS COMMITTEE, STATE OF CALIFORNIA; AND STEVE DUSCHA, DIRECTOR OF CWETA, CALIFORNIA STATE EMPLOYMENT DEVELOPMENT DEPARTMENT

Mr. **Dymally**. Thank you, Mr. Chairman.

First, I am very pleased and proud to have this opportunity to appear before you, and wish to commend you for conducting these hearings.

To the right of me is my friend and colleague, Senator Bill Greene, who is chairman of the California Senate Industrial Relations Committee and who is the author of a very innovative piece of legislation about which we shall be talking. To his right is Mr. Ben Munger, who is the economist for the Senate Industrial Relations Committee, and to my left is Governor Brown's representative who heads and monitors this worksite project.

I would add here that this is probably the most innovative piece of legislation affecting work and innovation and productivity. Governor Brown has taken a special interest in this, and he and I hope to sponsor a meeting in Southern California sometime in the spring of next year dealing with this project.

Mr. Chairman, as we conclude this series of hearings on "The Human Factor in Innovation and Productivity," it is appropriate for the committee to learn of a California experience that today is addressing some of the problems we have heard so much about.

In previous testimony we have heard remarks centered around the implications for productivity of changes in the nature of work, the change from an industrial society to an information-based society. We have heard about the changes in the demographic makeup of America's work force and all that they portend. Most significantly previous witnesses have talked about a new breed of worker who wants more than a paycheck from his job.

In general terms we have heard several proposed solutions to the problems of people and productivity. We have learned about Scandinavian and Japanese approaches to the problem. We have heard reports of the participatory management movement and the drive for industrial democracy as methods to improve productivity, and I believe we all agree that government should work together with business and labor in a cooperative, not an adversary role.

However, there is another group of productivity issues that is related to much of the testimony we have heard, but is often overlooked. These problems revolve around critical shortages of skilled labor in certain industries today. When there is no labor at all to perform a job, the implications for productivity are staggering.

But alongside this shortage of skilled labor, and sometimes in the same plant or office, we have uncounted numbers of unskilled people trapped in dead-end jobs that offer few rewards and little hope for advancement.

This group of unskilled workers, too often made up of minorities and economically disadvantaged people, constitutes a shameful waste of human talent and productivity. This waste of people is all the more distressing because—with assistance from their employers, from educators, and from government—these same people can learn to perform the skills that are in demand. They can fill the jobs that are going empty, even in the midst of chronic unemployment in this country.

As these unskilled workers learn, increase their productivity and move up, they will open jobs at the bottom of the ladder for those still unemployed. People will then have a chance to climb the ladder themselves.

That is what the California Worksite Education and Training Act does. It matches people and jobs. It increases the productivity of those who are unemployed and of those who are underemployed. At the same time this employment model fills business' demand for skilled workers.

Mr. Chairman, I have introduced H.R. 3326 to create a National Worksite Employment and Training Act based on the California job training model. H.R. 3326 is also consistent with the President's plan to stimulate the private business sector in this country by providing employers with complementary worksite training to a greater extent whiie simultaneously decreasing the number of individuals who depend on Federal assistance programs. It is an approach to one of our productivity problems that deserves our attention and support.

Mr. Chairman, I shall, if you don't mind, join you so I will have a chance to question my Senator—an experience I have not had in quite some time. I will try my best to give him a bad time.

Mr. Chairman, I turn it over to Senator Greene.

Mr. **Lundine**. Senator Greene.

Mr. **Greene**. Thank you very much, Mr. Chairman.

Mr. **Lundine**. Excuse me. Your entire statement will be made a part of the record.

Mr. **Greene**. Fine. I think that I will let Mr. Munger who is really my technician give the body of the testimony, and if it meets with your permission I'll bat in the clean-up position and let Mr. Duscha and Mr. Munger go ahead of me, and I'll just add some remarks to our written testimony.

I think it may be best, Steve, or Ben.

Let me introduce a gentleman who has been with me, I would guess, of my 16 years at the end of this year—I guess he's been with me I would say 15 of those 16 years. He's an economist and has added a great deal to my ability and a whole host of my colleagues' ability to begin to look at some new approaches to build some new thinking into what we do in California as relates to jobs, and with that introduction I'll have Mr. Ben Munger proceed from here.

Mr. LUNDINE. Again, the testimony of Mr. Munger and Mr. Duscha will be received in its entirety into the record.

Mr. Munger.

Mr. MUNGER. Mr. Chairman and members of the subcommittee, I am grateful to have this opportunity to describe to you this morning some of the background thinking that preceded the development of the California Worksite Education and Training Act. Those of us who have worked closely in developing the CWETA concept feel that the preliminary data on its effectiveness deserves to be reviewed by those interested in the problems of unemployment and productivity.

The California economy experienced two serious business recessions between 1970 and 1976, each of which had negative consequences for the State's rate of unemployment. Following the 1976 economic downturn the California economy experienced a phenomenal rate of recovery. For example, during 1978 California business and industry created 600,000 new jobs.

This growth within the job market continued on into 1979. Total employment during the month of March of that year was estimated by the Bureau of Labor Statistics to be 10,084,000. This represented a growth of 324,000 jobs over the month of March of the prior year—1978. In other words, the California job market generated a net increase in employment of 324,000 jobs. That is, the number of new jobs created minus the number of jobs that disappeared within that same period.

Despite this unprecedented level of new job creation unacceptable high levels of unemployment continued to persist within the State. An analysis of the labor market data suggested several reasons why the unemployment rate did not decline as one would have expected with the expansion in the number of additional jobs.

In general, the continued high level of unemployment stemmed from the fact that the number of persons within the work force was also expanding at a rate greater than the increase in the number of new jobs being created.

A close examination of the then available data also revealed that not only were there many entry level jobs not being filled due to the lack of basic skills on the part of the applicants interested in those jobs, but also there was a significant number of good-paying jobs, particularly in the health and the electronics field that were not being filled or were being filled through out-of-state and overseas recruitment.

There has long been a number of Federal- and State-sponsored job training programs in operation within California. These programs provide a general rather than specific type of job skill training. In other words, these programs concentrated on familiarizing the trainees with the various types of equipment and the skills he or she would need in order to compete successfully in the job market.

In most cases the general training approach is satisfactory in meeting both the needs of industry and workers, but there were certain entry level situations, as identified by the California Employment Development Department where the employer's demand was for a narrower specific skill development rather than a general skill training approach.

It was felt that this demand for a specific type of skill training that was desired by certain employers could be achieved if a closer working relationship between the employers needing specifically trained entry-level employees and the various educational delivery systems were to be developed.

Working in a partnership arrangement the employer could identify the precise skills needed while the educational system could then proceed to develop a training program which would equip the prospective entry-level employee with the defined skills.

For the last two decades there has existed in California an acute shortage of registered nurses. Even with out-of-state and overseas recruitment the shortage continued to be critical. The problem stemmed from the fact that California institutions of higher learning were not producing the required number of qualified nurses to serve the State's ever growing needs.

Studies developed by Governor Brown's staff noted the fact that licensed vocational nurses—LVN's—had on the average already acquired 88 percent of the skills required of a registered nurse.

The State's registered nurse program at that time was under the jurisdiction of the formal institutions of higher learning. Their full-time academic program required several years to complete. There simply was no other access to the nursing profession.

As a result licensed vocational nurses, who generally were minorities and women—single-parent heads of families—could not advance to registered nurse status simply because they were unable financially to enroll in a full-time academic program.

In addition, many of the licensed vocational nurses would have needed special help to overcome various academic shortcomings. Here was a group of workers whose productivity was limited by the fact that they were unable to advance in their profession.

It was also noted that if the licensed vocational nurses were able to advance and partially satisfy the demand of the health community for registered nurses there then would exist an equal number of new entry-level job openings.

If a delivery system parallel to the already existing academic nurse training could be developed several problems could be resolved simultaneously.

First, the existing shortage of nurses would be resolved.

Second, a group of workers already successful in their chosen profession would be given an opportunity to advance.

And finally, a number of unemployed individuals would be given an opportunity to become employed in an industry with an already established career ladder.

This type of program would increase the productivity of the already employed licensed vocational nurses as they assumed increasing responsibility and would at the same time increase the productivity of the new entry-level workers as they advanced in the health care field.

I would like at this point here to give you an example of how this program works.

In Children's Hospital in Alameda, Calif., they have a special ward there for children and infants who have terminal diseases.

The amount of time that a nurse can work in this kind of environment didn't average much more than 6 months before they burned out. Interestingly enough there were licensed vocational nurses who were working in these wards for as much as 20 years without burning out.

CWETA signed a contract with Children's Hospital to upgrade these LVN's into RN's and at the present time when these nurses finish their training program they take over the jobs that have had this rapid turnover of nurses.

This would mean automatically that the productivity of these new nurses would increase as they moved from LVN's up to RN's. The ward's productivity would increase since the staff were able to stay on the job for longer periods of time, and with the longer periods of time on the job the higher would be their productivity.

At the same time that the problems of the health care industry were being examined it came to the attention of the State's policymakers that the California electronics industry was also undergoing similar labor shortage problems. Up to the midseventies this industry had recruited its high-skilled electronic workers from the pool of discharged vets who had received their electronic training while serving in the Armed Forces.

With the end of the draft the size of this available pool of highly skilled workers began to shrink significantly. It was the feeling of the electronics industry that the already employed entry-level assemblers with a certain amount of additional training could successfully be upgraded to meet the everexpanding demand for higher skilled workers.

Again it should be noted that as this group of workers moved upward to more satisfying and better paying jobs the availability of new entry-level jobs would also expand.

Senator Greene introduced the California Worksite Education and Training Act into the California State Senate on December 17, 1978. It passed both houses and was signed into law on September 19, 1979, by Governor Brown.

This act was so structured that it could provide financial support in the form of stipends to trainees so as to offset any loss of earnings they may incur while attending class instruction which could not be provided outside of working hours.

Further, these programs would have their related classroom instruction closely coordinated and linked with the employer-sponsored career worksite training efforts so as to provide the most efficient and effective means possible for the employee to successfully advance in his or her chosen career.

Again, it should be emphasized that any time an individual in an entry-level position moves up the career ladder, an additional entry-level position automatically becomes open. In other words, two persons benefit—a worker is promoted and achieves certain economic and psychological rewards, while at the same time another unemployed jobseeker becomes gainfully employed.

One of the important features of the California Worksite Education and Training Act was that it mandated that the employment development department provide for evaluation studies to determine the effectiveness of this program. Preliminary reports on the effectiveness of this program are now available for your review.

And Mr. Steve Duscha will in his testimony discuss the results of these evaluations.

Individuals involved in the development of the California Worksite Education and Training Act generally feel that any successful resolution of the unemployment problem will follow from a recognition of the fact that the causes of unemployment are multifaceted in nature. In other words no single program can or ever will resolve the problem of unemployment. The California Worksite Education and Training Act concept has been successful simply because it confined itself to those industries which were unable to meet their need for new highly skilled workers.

These industries were desperate enough to agree that they would cooperate with the California Economic Development Department and training institutions—both public and private—to develop the curriculum so necessary for the successful upgrading of entry-level workers. They also agreed to hire disadvantaged new entry-level workers at the same time that these workers were undergoing their training.

The California Worksite Education and Training Act often called CWETA, has proved successful in reducing the unemployment level in California while at the same time increasing worker productivity.

Thank you for the opportunity to share with you some of California's experiences in the development and operation of the CWETA program.

Mr. LUNDINE. Thank you.

Mr. Duscha.

Mr. DUSCHA. Mr. Chairman and members of the committee, I commend the members of the committee for undertaking these hearings. The issues you are examining—particularly those involving training—are too often overlooked.

We have 7.7 million unemployed in this country today, yet in the electronics industry and the machine trades, in nursing and other fields we have a critical shortage of skilled labor. Jobs are simply going begging. But with 7 million unemployed we obviously are not short of manpower. What is the problem? Have we become too stupid or too lazy to perform the technical jobs that are in demand today? I don't think so.

The problem, I believe, is that too many Americans are stuck, dissatisfied and bored, their human capital grossly underutilized by a system that puts them in an entry-level—beginner's job—and then gives them no opportunity to move up to better paying and more challenging jobs—the kinds of jobs that are more and more replacing the repetitive assembly line work of the past. Let me give you an example.

Let's imagine a worker in the electronics industry, supposedly at America's cutting edge of innovation. But our worker is not an engineer designing a more powerful chip—he's a production worker, perhaps in California's Silicon Valley working on an assembly line, bent over a work bench soldering the red wires to the red wires, day after 8-hour day, week after week.

What do you suppose our assembler thinks about as the hours go by? How to increase his productivity? I doubt it. He's more likely to be thinking about some of the paradoxes of his existence.

Perhaps our assembler is a young black from an inner city welfare family who got his job after being trained by a well-intentioned community organization supported with Federal job-training money. This is our assembler's first job but it doesn't take him long to realize that even though he is part of the electronics revolution his is a pitifully small stake in that revolution. He is paid little more than the minimum wage and would be as well off on welfare.

And most important, his chances of moving on to better-paying jobs are slim.

Nobody told our assembler that the American dream of working your way from janitor to corporate president or from assembler to electrical engineer is no more. It takes formal education and training to make the move into the mainstream economy, the economy that is growing, has better wages and working conditions and offers an opportunity to move up the economic and social ladder.

That's not all. After our assembler has been on the job for a few months he begins to realize that his company is working hard to automate his job away—or move it out of the State or out of the country where labor is cheaper.

Our assembler has also noticed a shortage of skilled workers that already exists in the plant where he works. It's not just engineers and Ph. D.'s that are in short supply, it's technicians, people with a little college education, a little experience on the job, the people who operate the new machines, test and repair the electronic components and work hand-in-hand with the engineers designing the next generation of machines that will build the next generation of products.

And the cruelest paradox of all for our assembler is that he knows that he could be a technician. He watches them on the job every day. The work is not so hard, but it requires training. And the only way for our technician to get that training is to quit work and go to school full time for a year or two—a luxury he cannot afford.

In California we have another idea—the California Worksite Education and Training Act. Our concept behind CWETA, as the California program is known, is very simple. We have a shortage of people to fill midlevel technical jobs in certain industries, and we should concentrate our education and training on preparing people to work in those industries.

To insure that people are properly trained requires a partnership among business, labor, government, and educators. It requires a combination of on-the-job and classroom training, much like old-fashioned apprenticeships. And finally, we are focused on upgrading, on moving people like our assembler into the mainstream economy.

California has committed $25 million in State funds to the program for its first 3 years. To date we have funded 88 separate projects that eventually will train 7,000 people for 340 separate employers. Two-thirds of those who will be trained will be upgraded as our assembler might be. The other third will be prepared for entry-level jobs, but entry-level jobs with a difference—jobs that are linked to a specific upward mobility plan with each employer where the trainee works.

Our initial programs have emphasized training in electronics and other technical fields, and so far we have supported training in these fields for 3,600 people, working at 58 individual companies around the State.

We have also—as was noted earlier—concentrated in nursing where critical shortages have existed all over the country for years. We have authorized the training of almost 1,000 nurses at 154 hospitals in California and in a little more than a year we have come to support the training of more registered nurses than any single community college in the State.

We are also supporting training for machinists and other machine trade occupations, drafters, engineering designers, energy conservation workers, firefighters, and chefs. We have experimented with upgrading the skills of owners of small farms and their fieldworkers. We have a project to train computer programers and expect to establish the first apprenticeships for programers in the country.

Each CWETA project starts with a business that needs trained workers. In exchange for State assistance in creating a tailor-made-training program for an individual business the business agrees to hire—in an entry-level program—or promote—in an upgrade program—all those who successfully complete the training.

This commitment to hire is perhaps the most important single element in making a CWETA training program work. A commitment to hire and a job at the end of the training are the only sure indicators that there is a need for those who will be trained that is a very simple lesson but one that is often overlooked.

Most important, this commitment to hire means the employer has a powerful incentive to guarantee the quality of the training.

There are some other important checks and balances in the CWETA system. Labor involvement means a union interested in the best quality of training is also monitoring the progress of the project.

In addition, the person who is being trained must make a major commitment to the training program and has an obvious stake in its success. The training is rigorous and normally is after working hours, on the worker's own time.

And finally, the public schools which provide the classroom instruction provide one more check on the quality of the training.

Along the way I think CWETA has shattered a few myths for us in California. Myths about the impossibility of business and government working together, myths about how public schools are incapable of providing quality vocational education that meets the standards of hard-nosed business people, myths about government agencies unable to work together.

For me the most satisfying myth to shatter is the one that says people are basically lazy and don't want to get ahead and that few of us are capable of much beyond what we do today.

For me this myth disappeared forever in connection with a nurse training program CWETA is supporting at the Los Angeles County-University of Southern California Medical Center. Forty percent of the nursing positions at this huge hospital are vacant, and with the help of the union that represents the nurses we set up a program to train 45 nurse aides to be licensed vocational nurses and 60 licensed vocational nurses to be registered nurses.

We thought it was a pretty modest program, given the demand for nurses at the hospital. The hospital administration was skeptical that enough nurses could be found who were both interested and had the aptitude to go through the program. But after a notice went up for a general orientation meeting about the program 1,500 nurses turned out after work to learn about this upgrade program, and fully 800 of them submitted applications and took the entrance examination for the 105 positions in the program.

American workers want to advance and do a better job. What many need are the education and training tools to do it.

We have prepared for the committee a brief report describing our approach to training in more detail. It includes lists of our projects and a statistical profile of our trainees.

Thank you.

[The prepared statement of Steve Duscha follows:]

TESTIMONY

OF

STEVE DUSCHA

DIRECTOR

CALIFORNIA WORKSITE EDUCATION AND TRAINING ACT

STATE OF CALIFORNIA

BEFORE THE

SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 17, 1981

MAKING THE MOST OF OUR HUMAN CAPITAL:
THE CALIFORNIA WORKSITE EDUCATION AND TRAINING ACT

Mr. Chairman, Members of the Committee:

I commend the committee for undertaking these hearings. The issues you are examining--particularly those involving training--are too often overlooked.

Some of the previous testimony in these hearings that I have had an opportunity to review revolves around the so-called new breed of worker who wants something more than an eight hour workday and a paycheck to take home, the worker who expects to participate in the decisions that affect his working life, who wants, at the very least, to be an intelligent cog in a wheel, who wants to know what he can do for himself on the job and who might care about his company and the product he is producing if he thought the company cared about him.

A worker who dislikes what he is doing is more likely to produce less than a worker who is proud of what he is doing. But there is another side to the issue of people and productivity, one that is closely related to problems of worker dissatisfaction, but one that poses an even clearer and more immediate threat to our productivity. And that is the case where there are no workers at all to do the jobs that need to be done.

Demographers warn of slower growth in the labor force in the years to come, but in some industries the labor shortage is here today. We have 7.7 million unemployed in this country, yet in the electronics industry, in the machine trades, in nursing and other fields, we have a critical shortage of skilled labor. Jobs are going begging. Industries have made a science of enticing, pirating, stealing employees from firms down the street or from outside the country. There are businesses that cannot get their business done because they do not have trained people; hospitals must turn away patients because they do not have trained nurses to care for them.

With 7.7 million unemployed we obviously are not short of manpower. What is the problem then? Have Americans become too stupid or toc lazy to perform the technical jobs that are in demand today? I think not.

The problem, I believe is that too many Americans are stuck, dissatisfied and bored, their human capital grossly underutilized, by a system that puts them in an entry level, beginner's job and then gives them no opportunity to move up to better paying and more challenging jobs, the jobs that are more and more replacing the repetitive assembly line work of the past. Let me give you an example.

Let us imagine a worker in the electronics industry, at America's cutting edge of innovation. However, our worker is not an engineer designing a more powerful chip; he is a production worker, in California's Silicon Valley perhaps, working on an assembly line, bent over a work bench soldering the red wires to the red wires day after eight hour day, week after week.

What does our assembler think about as the hours go by? How to make a better red wire? How better to hold the soldering iron? How to move his assembly line faster? Or better?. How to best the Japanese in the microprocessor market? How to help his company's engineers build a better product? I doubt it.

Our assembler might be thinking about some of the paradoxes of his existence.

Perhaps our assembler is a young black from an inner city welfare family who got his job after being trained by a well-intentioned community organization supported by federal job training money. This is our assembler's first job, but it doesn't take him long to realize that even though he is part of the electronics revolution, his is a pitifully small stake. He is paid little more than the minimum wage and economically would be as well off on welfare. More important, his chances of moving up into better jobs are slim.

What nobody told our assembler as he went through his training is that he was being prepared to work in a secondary labor market that pays the minimum wage, where job satisfaction means only a paycheck and where skills are neither necessary nor attainable.

They neglected to tell him that the American dream of working your way from janitor to corporate president or from assembler to electrical engineer is no more. It takes formal education and training to make the move into the mainstream economy that is growing, that has better wages and working conditions and that offers an opportunity to move up the economic and social ladder.

But that's not all. After he's been on the job a few months, our assembler begins to realize that his company is working hard to automate his job away. Or move it out of the state or even out of the country where labor is cheaper. If our assembler is a student of economics, or just some one who looks at a daily newspaper, he's read that economists say automation is not so bad; that it eliminates dull jobs and creates more and better skilled jobs than it eliminates. But that doesn't help our assembler. He has no way to reach those higher skilled jobs.

But while he is worrying about his future, our assembler has noticed the shortage of skilled workers that already exists in the plant where he works. It's not just engineers and Ph.D.s that are in short supply. It's technicians, people with a little college education and some experience, people who will operate the new machines, test and repair the electronic components and work hand-in-hand with the engineers who are designing the next generation of machines that will build the next generation of products. These technicians are the people in short supply. Electronics companies raid other companies for technicians. They pay bounties and spend thousands of dollars to recruit a single worker. But there are no people to recruit. It's a new field, and trained workers either are not coming out of the schools fast enough to meet the demand or the ones who are coming out are not trained well enough to go to work.

The cruelest paradox of all for our assembler is that he knows he could be a technician. He watches the technicians on the job every day. The work is not so hard, but it requires training. And the only way for our technician to get it is to quit work and go to school full time for a year or two, a luxury he cannot afford.

In California we have another idea. In 1979 Governor Edmund G. Brown Jr. proposed the creation of the California Worksite Education and Training Act (CWETA).

The legislation was sponsored by State Senator Bill Greene of Los Angeles and was signed into law in September, 1979. Subsequently, Representative Mervyn Dymally introduced similar legislation to create the National Worksite Employment and Training Act (HR 3326).

Governor Brown's concept behind CWETA, as the California program is known, is quite simple. We have a shortage of people to fill mid-level technical jobs in certain industries today, and we should concentrate our education and training on preparing people for those jobs. To ensure that people are properly trained requires a partnership among business, labor, government and educators. And it requires a combination of on-the-job and classroom training, much like apprenticeship, which is not only the oldest form of job training, but is also one of the best. Finally, CWETA is focused on upgrading, on moving people like our assembler into the mainstream economy.

California committed $25 million in state revenue to the program for its first three years. To date we have funded 88 separate projects to train 7,000 people for 340 separate employers. Two-thirds of those who will be trained will be upgraded into higher skilled, higher paying jobs with their existing employer. The other third of the trainees will be prepared for entry level jobs that are linked to specific upward mobility plans with each employer where the trainees work.

Our initial programs have emphasized training in electronics and other technical fields and so far we have supported training in these fields for 3,600 people in 58 individual companies around the state. CWETA programs also have been concentrated in nursing where critical shortages have existed for years. CWETA has authorized the training of almost 1,000 nurses at 154 hospitals around California and in a little more than a year has come to support the training of more registered nurses than any single community college in the state.

We also are supporting training for machinists and other machine trade occupations, drafters, engineering designers, energy conservation workers, firefighters and chefs, and we have experimented with upgrading the skills of owners of small farms and their field workers. We have a project to train computer programmers and expect to establish the first apprenticeships for programmers in the country.

CWETA's cost per person trained is about $2,300. Our administrative overhead, which we have worked diligently to keep down, adds about another $300 per person to the costs. Unlike some training programs, CWETA does not attempt to finance the entire cost of a project. Classroom costs generally are financed like any other educational program through the basic school financing system in California. CWETA can pay the extra costs incurred by a school district in developing a program tailored to a particular business and also can pay for increased costs of supervision, administration and other added costs a business incurs through special on-the-job training.

Each CWETA project starts with a business that needs trained workers. The California Employment Development Department, which administers the CWETA program, brings that business and any union that represents its workers together with local community colleges or adult schools to work out a specific training program for the jobs the business needs filled. Representatives of the state Department of Industrial Relations' Division of Apprenticeship Standards also are often involved in setting up a project, particularly in designing the on-the-job training phase of the program. Other appropriate state and local agencies are involved in planning including local administrators of the Comprehensive Employment and Training Act. A separate training plan and budget are negotiated for each training package. A package may involve a consortium of small employers or one large employer. Single projects typically involve at least 15 participants and some may train several hundred. In projects that create formal apprenticeship programs, including many of CWETA's nursing programs and a few of our electronics programs, joint labor-management committees are established to operate the training.

In exchange for state assistance in creating a tailor-made training program for an individual business, the business agrees to hire (in an entry level program) or promote (in an upgrade program) all those who successfully complete the training. This commitment to hire is perhaps the most important single element in making a CWETA training program work. A commitment to hire and a job at the end of training are the only sure indicators that there is a need for those who will be trained. Most important, it means the employer has a powerful incentive to ensure that the training is of high quality and meets his needs.

There are other important checks and balances in the CWETA system. Labor involvement, particularly through joint labor-management apprenticeship committees, means that a union interested in the best quality training for its members is monitoring the progress of the project.

In addition, the person who is being trained must make a major commitment to the training program and has an obvious stake in its success. Training is rigorous and normally is after working hours, on the worker's own time. A person in training must make a major commitment of both time and energy.

Finally, the public schools which provide the classroom training provide one more check on the quality of instruction. CWETA programs do not seek to set up a new system of vocational education, but seek only to help business and labor make better use of the existing system.

CWETA was created by Governor Brown to resolve a serious and specific type of productivity and employment bottleneck in our economy, and it works. It works for employers who desperately need skilled workers, and it provides training and help in moving up for those who are part of the labor force, but only marginally so. And CWETA promotes the apprenticeship system of training, a proven method of practical education. CWETA does not pretend to solve all our employment or all our productivity problems. But it has provided training and, most importantly, has provided good jobs for people in California, and Governor Brown intends to build upon our experiences with CWETA as a model training program.

Along the way we have shattered a few myths. Myths about the impossibility of business and government working together. Myths about how public schools are incapable of providing quality vocational education that meets the standards of hardnosed business people. Myths about government agencies unable to work together. For me the most satisfying myth to shatter is the one that says people are lazy and don't want to get ahead, that few of us are capable of much beyond that which we do today. For me this myth disappeared forever in connection with a nurse upgrade program CWETA is supporting at the Los Angeles County-University of Southern California Medical Center. Forty percent of the nursing positions at this mammoth hospital are vacant, and with the help of the union representing the nurses CWETA set up a program to train 45 nurse aides to be licensed vocational nurses and 60 licensed vocational nurses to be registered nurses. The hospital administration was skeptical that enough nurses could be found who were interested and had the aptitude to go through the program. But after a notice went up for a general orientation meeting about the program, 1,500 nurses turned out after work. And 800 of them actually submitted applications and took the entrance examination for the 105 positions in the program.

American workers want to advance and do a better job. What many need are the education and training tools to do it.

That is the California Worksite Education and Training Act. It's a chance for nurses and for our electronics assembler and workers like them throughout California to move up the ladder and learn the jobs that need to be done today. CWETA is also a chance for their bosses to get the workers they need.

As Governor Brown recently said, CWETA "is a program in which everybody--employers, schools, unions, employees and the state--contributes and works together. It's an approach to job training that is working in California. It's a serious solution to a serious problem. It is a national model for building the nation's human capital."

Mr. DYMALLY [presiding]. Thank you very much.

Senator, as you know we have introduced your bill in the Congress. It is in the House Labor and Education Committee, but this committee, of course, has an interest in it, so I want to ask you some questions about the mechanics of its operation.

Could you just tell us what happens at the initial stage? Who puts what together? How does the State get into the act? Where do you get your money?

Mr. GREENE. Steve might be better able to——

Mr. DUSCHA. We start out with an employer who is looking for workers. We sit down with that employer, help him figure out exactly what he needs, get him to sit down with a local community college or adult school, and design a custom-made-training program for an individual employer to get the people he needs.

We often bring in our State apprenticeship people to help design on-the-job training. Then we put the package together and negotiate some funding.

Our basic theory in funding is that everybody has some extra costs of conducting a training program in a new way, which is what we are trying to promote. The State funds will cover the increased costs of business, educators, and in some cases of the trainees themselves in going through a training program of this nature.

Mr. DYMALLY. So the State pays the cost of the training or educational portion of the program?

Mr. DUSCHA. Yes. Some of that is through the CWETA fund, some is through the basic educational financing system, the regular financing system for community colleges and adult schools.

Mr. DYMALLY. What do you do for the trainee employee who lacks adequate transportation?

Mr. DUSCHA. We can pay a stipend for economically disadvantaged persons. We also have minor allowances for transportation, child care, things like that.

The typical case, however, is where the person in training is also working—producing and earning a salary at the same time.

Mr. GREENE. Congressman, I think I hear another aspect of your question, as to how does all this come together in the first place.

What happens is that the program is advertised, through business associations, chamber of commerce, manufacturers associations. The State also notifies interested parties of the existence of the program and what it offers in trade journals, and publications of that nature. That's how the private firms and the employment development department get together in the first place.

In certain instances in the Los Angeles area, for example, particularly as the nursing programs came together, the initiative was exercised on the part of the employment development department.

Mr. DUSCHA. May I add that there has been much initiative, particularly in nursing, by the Service Employees International Union which represents nurses.

Mr. DYMALLY. The community colleges in my district and the King Hospital had some difficulty because the State law requires a ratio for nursing that they said they could not afford. But you solved it at the U.S.C.-County Hospital. Why are we having difficulty in our district?

Mr. **Greene**. I don't know all the facts of that, except that of course, the USC General is so much larger, and the personnel complement is so much larger that, of course, they're well able to make that ratio, whereas you do not have the same size of medical staff at the Martin Luther King Hospital. That's one problem.

Mr. **Dymally**. And the Southwest Community College?

Mr. **Greene**. Right.

Mr. **Duscha**. Another issue there is that the community colleges tell us that nursing is a very expensive program for them to deliver—they get paid a per capita fee by the State. They say if they add more nursing programs, they lose money. We say, we'll make up some of the difference there and make it more attractive for you.

Mr. **Dymally**. Mr. Chairman.

Mr. **Lundine** [presiding]. Go ahead.

Mr. **Dymally**. The employee is guaranteed a job the day he enters, so he is not training for a job. He's on a job and then he gets training to upgrade his skills and his position.

Mr. **Duscha**. He gets the job if he successfully completes the training—yes.

Mr. **Greene**. If he washes out of the training, of course, he doesn't get the job. If he successfully completes the training, he has a job.

Mr. **Dymally**. While he's in training, does he get paid by the State or does he get paid by the employer?

Mr. **Greene**. By the employer, with backup by the State.

Mr. **Dymally**. Now in the CETA program, you have a financial test for employment. Do you have a financial test—for the person that is above the poverty level? Could they benefit from your program?

Mr. **Greene**. Certainly. In fact, the program is also used to upgrade. You could be holding a job, for example, if you were an LVN and you were in the program to upgrade to an RN. As an LVN, you could be making $8,000 or $9,000 a year. You then could enter CWETA, and upgrade yourself to RN through the CWETA program. You're definitely above the poverty level. You aren't living very well, but you are above the poverty level at $8,000 or $9,000 a year.

Mr. **Dymally**. A final question—what sort of incentive does the employer get?

Mr. **Greene**. The employer, of course, is going to be able to upgrade their work force in a shorter period of time. Say, for example, in the nursing program, because we are able to cut the time cycle.

Additionally, the employer has someone who is on the job, upgrading at the same time, so they are productive all along the route, and they're better able to plan their overall personnel makeup because they know who they're going to have in place at what point in time.

Mr. **Dymally**. Does the employer get a tax incentive?

Mr. **Greene**. Only if the person is entry level and is in the "disadvantaged" group. They can qualify for a tax credit under Senate bill 93 which was an accompanying bill to this; and under that we actually copied the formula which I think Congressman

Rangel and some of the other Members of Congress were instrumental in putting into law here nationally—and they can get up to a maximum of $600 a year for a maximum of 3 years.

Mr. DYMALLY. Thank you very much, Mr. Chairman.

Mr. LUNDINE. First of all, let me say that this is a fascinating experience and one that at a statewide level in the largest State in the United States parallels my own experience in a small community in upstate New York regarding the needs of training. In order to create jobs, you need to upgrade the skills of people already working more often than you need to train people for entry-level jobs.

Industry can take care of the entry-level training which is minimal, but often that upgrading is beyond their capacity on an individual-firm basis, and it's just really interesting, informative, and worthwhile to have your testimony. Because, after all, you have to have skilled workers if you're going to improve the human factors affecting productivity and innovation—which we're looking into here.

One question I have about the process. Actually, I guess I have a couple. How do you identify the skills which are needed? Specifically, is labor involved in that in any way?

Mr. GREENE. I will have to defer to Mr. Duscha for that, Mr. Chairman.

Mr. DUSCHA. In an organized setting where a union represents the workers, labor is a full partner. In putting the project together we've had situations, particularly involving the Service Employees International Union and hospitals, where labor has taken the lead. In other cases, they have followed management. But in all cases, labor has a signoff, management has a sign-on.

Mr. LUNDINE. So you're really causing a dialog between labor and private enterprise about the skill needs of that enterprise?

Mr. DUSCHA. Yes. And often both parties are a little nervous about it until they get into it, and then we find that they get along very well.

Mr. LUNDINE. Does the company guarantee the job? In other words, as a condition for this training, do they guarantee that there will be a job at that higher-skill level after the completion of training?

Mr. DUSCHA. Yes.

Mr. GREENE. Mr. Chairman, I might add to Mr. Duscha's response that in the case, of an area which is not highly organized, such as some aspects of the electronics industry in Silicon Valley, the process takes place with the private employer and the Employment Development Department and the educational institution—whatever educational institution is involved. Or if the employer wishes, the training takes place right there at the jobsite. So that is an arrangement that comes together involving only the employer, the educational institution if they are involved, and the Employment Development Department.

Now those jobs are identified by the Employment Development Department which is looking monthly at the expansion of various industries or keeping track, as well as the State can, of what the potential work force is, and things of that nature.

So with the Employment Development Department as kind of the umbrella agency, we are able to spot where these needs are going to be. Of course, we are able to see where the growth areas are. For example, in the service industries, and in the health and medical—whatever.

Mr. **Lundine**. But to have it work ideally, you've got to have that communication between private enterprise and Government. With all due respect to your employment service, sometimes private enterprise will be able to anticipate a skill need before it would be quantifiable by unemployment statistics or industry growth statistics.

Mr. **Greene**. Private enterprise is the driving force in this. In fact, the private employer really structures the training program for the employee.

Mr. **Lundine**. What we need to do—not only in California but across the country, I think—is to develop an atmosphere where private enterprise will feel comfortable and feel as though it is in their interest to open up a dialog where they can anticipate skill shortages in the future.

Do you think that California industries that have been involved in this would be willing to continue if there was no government financing?

Mr. **Greene**. I don't know. I would say in some cases where the need was the greatest, after having had a degree of success, obviously some would. Some others would not. I think you would have mixed results, Mr. Chairman.

Mr. **Lundine**. I was impressed, and I am always impressed when people approach things on a logical, troubleshooting, problem-solving basis. And I was impressed with the comment, for example, that strikes right home about the community colleges not wanting to train nurses because they lost money on every nurse they trained. And after all they are, in a sense, in a business, too. And I understand that so clearly.

But that's where I think government at its best, in this case State government at its best can solve a problem. You can go in and make it more worthwhile to meet what is clearly a need in terms of training, and that is to at least make them concentrate on the training of nurses instead of churning out—well, I always pick on beauticians, but I always say how many beauticians does this area or this country need?

Mr. **Dymally**. I think an added incentive is the presence of the State agency negotiating with the community college and saying, "We will make up your loss." The Governor's office and the legislators, assist in giving some assurance that you're not going to have a net loss.

Mr. **Lundine**. Exactly. It's the spirit that I've been able to glean from this program that to me is exciting. It's not a big-money program; you're not holding out that government is going to do everything, solve every problem, but you've gone in and you've identified where the critical blockages in the whole system are, and then you've solved that problem. That's really exciting.

Let me just ask one more question. What do you think that the Federal Government role should be to help stimulate States to setup a CWETA-type program, and you know the context I'm asking that—within the framework of the kind of budgetary restraints that we're working with?

Mr. GREENE. Mr. Chairman, you know, frankly, insofar as the Senate Industrial Relations Committee is concerned, and not withstanding the initiative Governor Brown and his staff, it was budgetary restrictions, proposition 13 and the fact that we were not going to have the same level of public funds available—that motiviated us to move at the point in time that we did.

We visualized that we were going to have fewer public dollars, and frankly, in this program, we did nothing new. We took the pieces that were already there and tried to shape them in a logical, rational direct-line manner, for the very reason that you're faced with here at the national level—we were faced with a proposition 13 in California.

Mr. LUNDINE. It's exciting. I hope we react to it as creatively as you did.

I hope that the private sector, and I don't want to get into the gibberish and call it a private-sector initiative because that has certain political connotations, but I hope that the private-sector efforts that are typical of what we heard about yesterday at Motorola, an enormous United States company able to use the CETA program, interestingly enough, in Fort Lauderdale, Fla., and the kind of thing that you're doing with this program in California can be retained while cutting out some of the obvious waste and inefficiency of the CETA program.

I am sure you were frustrated as we were in trying to adapt CETA regulations to the kind of creative thing you were doing.

Mr. DUSCHA. Much of what we are doing here could be done through CETA, but it isn't.

Mr. GREENE. I've never been a fan—and I don't mean it to be critical and it's nobody's fault necessarily—I have never really been a fan of many of the manpower and training programs as we have known them. I have always felt that they were not straightline—that they did not offer anything proof-positive at the end.

And, frankly, when we all sat down together with the administration, with Mr. Munger and the community college people and what-have-you, we tried to—we had to battle some people, but we succeeded in making this as direct-line as possible, and in making certain that we were in fact putting a person in an employable situation.

I might add, Mr. Chairman, that we do this at less cost than most of your training programs, per individual.

Mr. LUNDINE. Doesn't surprise me at all.

Mr. GREENE. We trim it down very, very close.

Mr. LUNDINE. Well, I guess in that connection I would only observe that I understand what you're saying very clearly, Senator, and I guess that the way to hell is paved with good intentions, and all those manpower programs you described certainly were well intended—many of them didn't work—and I thank you very much for showing us a way, of a program that does work, and for identifying some of the principles that made it work.

If there are no other questions I'd like to thank you for coming such a long way to tell such an interesting story. You've made a real contribution to these hearings. Thank you very much. I assure you that we intend not just to have hearings for the sake of it, but we do intend to make some recommendations to the Science and Technology Committee and other committees of the Congress as a result of this. So perhaps your experience can be broadened and nurtured.

Thank you.

Mr. **Greene**. If we can be of any assistance to you I assure you that we are available to do so. Thank you.

Mr. **Lundine**. The subcommittee would now like to call on Mr. Rahn, vice president and chief economist of the U.S. Chamber of Commerce.

Welcome. Mr. Rahn, if you would identify your associate, just in case.

[The biographical sketch of Mr. Rahn follows:]

RICHARD W. RAHN

Dr. Richard W. Rahn joined the Chamber of Commerce of the United States on February 1, 1980, as Vice President and Chief Economist. He also holds the positions of a Director and Vice President of the National Chamber Foundation. As Chief Economist, he manages the Chamber's Economic Policy Division which includes the Forecast Center, the Survey Research Center, Tax Policy Center, Trends and Perspective Center, Productivity Center, an Inflation Improvement Program, Government Budget Program, and the Economic Policy Center. In addition, Dr. Rahn serves as a Chamber liaison with, and spokesman before the U.S. Congress, the national news media, and other Chamber, association, civic, business, and professional groups on economic and tax policy issues.

Prior to joining the Chamber staff, Dr. Rahn served as Executive Director of the American Council for Capital Formation (January 1976 to February 1980), and Chief Executive Officer of the American Council for Capital Formation: Center for Policy Research. He remains a member of the Board of Directors for both the Council and the Center.

During 1973 and early 1974, Dr. Rahn was Managing Director of the Ripon Society in Cambridge, Massachusetts and Washington, D.C. From 1974-76, he was president of a managerial and political economics consulting firm in Washington, D.C. He also served as the Washington economic consultant for the New York Mercantile Exchange, 1974-80.

From 1966-73, he served on the graduate faculty of the Polytechnic Institute of New York, where he became an Associate Professor of Management and Head of the graduate Department of Management. While associated with the Polytechnic, he served as Administrator of the AID-sponsored Rural Industrial Technical Assistance Program in northeast Brazil. He has also taught graduate courses at George Washington University and Rutgers University. During the years of 1964-66, Dr. Rahn was an Instructor in marketing at Florida State University, and also with the U.S. Air Force Bootstrap Program. He has served on the adjunct faculty of George Mason University where he taught graduate courses in managerial economics and international business (1975-81).

He is a member of the International Club of Washington, D.C., Beta Gamma Sigma (national business honorary), the National Economists Club, the American Economics Association, National Tax Association - Tax Institute of America, and is the former president of the National Capital Chapter of the National Association of Business Economists. In addition, Dr. Rahn serves as a member of the U.S. Department of Labor's Business Research Advisory Council.

Specializing in economic and tax policies issues, Dr. Rahn has addressed many professional, business, academic and civic groups. He has frequently been a guest commentator on tax and economic issues on national radio and television, and often testifies before Congressional committees. In addition, Dr. Rahn has authored many articles on domestic and international economic policy, which have been published in newspapers, magazines, and professional journals.

Dr. Rahn earned his Ph.D. in business economics at Columbia University (1972); M.B.A. in marketing at Florida State University (1964); and B.A. in economics at the University of South Florida (1963).

Born in Rochester, New York on January 9, 1942, Dr. Rahn attended public school there and in St. Petersburg, Florida.

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7/81

STATEMENT OF RICHARD RAHN, VICE PRESIDENT AND CHIEF ECONOMIST, U.S. CHAMBER OF COMMERCE; ACCOMPANIED BY CARL NOLLER, DIRECTOR, U.S. CHAMBER OF COMMERCE PRODUCTIVITY CENTER

Mr. **Rahn**. I am accompanied today by Dr. Carl Noller who is director of the U.S. Chamber's productivity center and has direct responsibility for the management of our productivity programs.

It is a pleasure to be here today, Mr. Chairman, and I thank you for inviting us. I am Richard Rahn, vice president and chief economist of the Chamber of Commerce of the United States.

We have prepared a statement, and I hope we can have that included in the record.

Mr. **Lundine**. Thank you very much. It will be, without objection, included in its entirety in the record. Please proceed as you like.

Mr. **Rahn**. Well, briefly, the U.S. Chamber has been long aware that the only way we increase per capita incomes of our citizens is through productivity growth. As the committee is well aware the productivity growth rate record of this country for the past decade has been dismal, and particularly for the last few years.

To this end we had established a productivity center at the chamber for the basic purpose of giving us a greater understanding of the sources of productivity growth and the impediments to productivity growth. Our findings and recommendations are disseminated to our members, to elected officials, to the news media, and others.

We have turned out a series of publications, most recently and notably a publication entitled, "Productivity, People, and Public Policy," which goes through both the sources of productivity growth, the reasons for our slowing growth, and what we can do about them.

We have turned out a series of articles, and we have been holding conferences on productivity growth—bringing experts in from various disciplines concerned with productivity growth.

Unfortunately, there is still neither wide agreement not a full understanding of the specific factors that result in rapid rates of productivity growth. We do know that productivity growth is a function of capital investment per worker. We know it is a function of the organizational structure of institutions. We know it is also a function of both worker and management attitudes toward productivity growth and the incentives provided to both.

The Congress made a major step forward this past summer—with the passage of the tax bill—something the chamber had sought for a long time.

We have no doubt that this legislation will result in reducing the impediments to capital formation, which should greatly increase our productivity growth. In terms of organizational structure, attitudes, and incentives for both workers and management, much more work needs to be done.

In the last few years the U.S. Chamber has engaged in a number of surveys and studies of both worker and management attitudes toward productivity growth. Dr. Carl Noller has been supervising this effort, and he will briefly summarize our most recent findings for you.

Mr. Noller. The chamber is about to release within the next couple of weeks what we are calling management attitudes toward productivity. This survey that is a sequel to the very successful workers attitudes toward productivity that we conducted at the end of 1979.

Basically we sent out a questionnaire in January of this year to 1870 top executives in this country. We got back more than sufficient number of responses to have this considered to be a scientific sample.

So I think it's important to understand that our results are not merely a poll of a certain number of people. Rather, you can assume that within a small margin of error the results that we got actually reflect the broad cross section of American management opinion on productivity issues. I think that's important to understand.

What we attempted to accomplish with this survey was to learn about five concerns. We wanted to know what American management perceived as the solution to the problem. What did they think needed to be done?

We wanted to see how those attitudes compared with what we had found previously in the worker attitude survey. Were there great differences on certain issues that could properly be jointly addressed?

Had management attitudes changed? We conduct periodic surveys on a regular basis and we had inserted isolated questions previously, and we had gotten answers, particularly on this notion of what they perceive is the problem or what they thought ought to be done to effect a better productivity performance. So we wanted to compare those isolated questions with the more detailed results of our 1981 survey.

We wanted to see to what extent the answers that we got from that survey compared with what economic researchers were telling us as they used econometric techniques to find what they believe to be answers to the productivity problem. We wanted to compare them.

Finally, and I think perhaps most importantly, probably for this group and for us as well, did this perception of the productivity problem translate into actual action? That is, what were the companies doing to aline their policies with the perceptions of the productivity problem that they had related?

Our findings were these:

The current results that we got from the January-February 1981 survey corroborated our own past findings done in 1978 and 1980 showing that business believed that there was a compelling need for less Federal regulation, a better business climate, improved worker attitudes, more capital investment, and a lower level of taxation. Those were the things that they ranked highest.

There is a complete table in our written testimony where there were about 15 different choices presented. But those were the ones that they tended to rank highest from this group of 15.

We found, a little bit to my surprise, in this last survey, when we asked specifically about inflation, that a better business climate means less inflation.

Seventy-one percent of the people that we surveyed said—and this was the most frequently mentioned response—lower inflation would be the greatest thing that could improve their productivity performance. I found that very interesting.

The results that we had from this survey, and indeed from our previous findings, are consistent with the recent survey by the congressional task force on industrial innovation, chaired by Representative AuCoin.

Now, when we compare these results on causes with what workers had told us in our 1979 worker attitude survey, we found some differences.

Workers, interestingly enough, place a greater emphasis on attitudes, and surprisingly, workers felt that the greatest improvement that could be made to raising productivity was in their own area of worker attitudes and abilities. It's what our survey found when we asked workers. That was the answer they gave us.

Fifty-three percent of all the workers we surveyed indicated that worker attitudes and abilities could be improved, and that would make a major contribution to productivity.

Thirty-seven percent of them indicated management attitudes.

Twenty-one percent indicated supervisory attitudes.

And those were the top three. In fact, quality of tools and equipment was also mentioned by 21 percent. That was the top four.

We found that when we compared what management was telling us, with what researchers have been finding, that there was a general agreement as to the problem.

General business climate, Federal regulation, and capital investment were seen by researchers as well as management as being contributing factors to our productivity slowdown.

There was some difference in emphasis, but basically an agreement on results.

Economists also pointed, however, to structural shifts in the economy, to rising energy prices, and to the changing composition of the labor force.

Economists had done no work reflecting attitudes—perhaps because they are very difficult to quantify and to test. This was something, of course, that both workers and management had placed greater reliance on.

We found that management, while it still saw Federal regulation and worker attitudes as impediments to productivity, was accepting greater responsibility for the slowdown in productivity improvement. There was a rather dramatic shift from our 1978 survey to our 1980 survey reflecting this change—more and more businessmen saying we have a part to play in this problem and its solution.

The surveys showed also that both business and labor believe that if workers were more involved in their jobs and involved in decisionmaking and consulted that they would effect a better performance. So then we asked some questions as to what they're actually doing, and I'd like to go very quickly to those results.

We found that compensation packages were being changed to tie performance to pay more closely than had been done previously. Fifty-two percent of the management people that we talked to indicated that they were linking in some way their compensation package to performance, to productivity.

Forty-six percent of the companies that we surveyed had a position or a staff whose primary responsibility was to improve productivity in the company

We found that of those companies that were unionized 46 percent had introduced productivity considerations into union negotiations. And we found that they were trying some new approaches to improve productivity in this country and increase motivation.

Quality circles apparently are being used in about 14 percent of the businesses that we surveyed.

There are several other innovative methods that have been suggested and about which we asked. These results are included in the written testimony.

At the same time we found that many firms, and especially small businesses, seem either not to recognize the problem or not to really know what to do about it. It is clear from our answers that larger business had done more in the way of innovative things to relate productivity to performance.

So it looks like there is something to be done with respect to small business.

In part I think this might be understandable because there is a lot that we don't know yet about productivity—particularly at the microlevel—what really works in the firm. And there are, as you are probably aware, hundreds of different panaceas currently being offered. Doubtless there is some confusion from this.

We expect over time that the answers to what works will become clearer, and we certainly hope and expect that the chamber's productivity center will play a role in helping to push back the frontiers of knowledge and to disseminate that kind of information.

Thank you.

Mr. LUNDINE. Thank you.

You talked about at least the economists citing structural shifts in the economy as one of the factors affecting it. Did your studies in any way try to identify particular trends in particular sectors of the economy, and I'll tell you why I am interested.

One, we've had a lot of testimony about basic industries—auto, steel are great examples. And they thought that they might have particular problems that deserved attention.

Two, I am interested in the growth industries—this committee particularly is interested in the high technology growth industries—and it's been implied if not directly expressed in these hearings that they may have some of their own special structural type problems impeding productivity, and particularly on the human dimension.

And most importantly, I wish you would have been here yesterday because I could have gotten your response to some of the testimony then. We heard testimony to the effect that while the impact of automation in the factory has been widely studied, particularly large businesses are adapting more now to what the workers' needs are, as well as what the needs of introduction of new technology and what the capital needs are, but that that's not happening in the offices. And I am wondering whether in your survey, was industry specific enough to know whether the same attitudes as prevail in big businesses prevail in insurance companies and banks and areas where you're not involved with factory situations, but you may be involved with the introduction of new technology which allegedly is dehumanizing the work place and actually making it more inefficient and even that there is no productivity gain as a result?

A long question.

Mr. **Rahn**. Unfortunately, our studies to date have not been sufficiently detailed to give you a reliable sample by various industry groups. I think, as a result of our earlier findings, we are going to be continuing along with this work. We would be more than happy to include in our future studies any suggestions or questions the committee has that have not been answered by other witnesses. We do ongoing studies of business confidence every 3 months. We always have a series of questions in the surveys, and we have a sufficiently large sample there that we can do some industry breakouts.

Earlier studies that we and others have done show that some of the heavy capital investment industries, in autos, steel, and some of the others, have had a particular problem in terms of depreciation. I think the Congress has cured that problem. At least we have gone a long way in the actions you all took this past summer. Again we applaud you for that.

In terms of office automation we have, of course, been collecting the various studies and testimony and opinions. It is clear there is a lot of technological process being made, but it is also clear that we do not have very good measures of output. Productivity measurement is becoming an enormous problem, as we evolve to more of a service society. In pure manufacturing firms, it is fairly easy to measure productivity. In the steel industry, for example, you know how many workers you have and how many tons of steel you produce.

But how do we measure the productivity of an attorney, of an economist—such as Carl or myself—or a Congressman? I am not sure. We have committees in the chamber struggling with that very question now. And I'm sorry we can't be more definitive today on the questions you have answered.

Mr. **Lundine**. My smile is laughing with you—not at you.

The wisest thing that ever was told to me about productivity was when I was mayor. A guy says to me you better be very careful how you define productivity because you are liable to achieve it.

And he gave the example of a police officer. If you define the productivity of a police officer by the number of arrests, you are going to get productivity. You may not have a better community, but you are going to get productivity.

Similarly, if we measure executives' productivity by the number of decisions per hour that they make or a lawmaker's productivity by the number of laws that they pass in a session, I am not so sure that our society is going to be better off.

I would only request that in your further deliberations—whether they're empirical studies or just dialogue that's necessary that you do look into this. A widely recognized professor in management from MIT, recognizing that measurement is difficult in the office said yesterday: "Frankly businesses are making enormous investments in office technology and then they're not even evaluating whether it did any good or not afterwards." He alleges, this is because they were afraid to know the results.

I'd be interested in management attitudes about that, not just the response of the vendor corporations, but management attitudes. Is it a fact that they're not evaluating it, or is it just a problem of measurement, or to what degree are they involving workers in the introduction of the technology?

Mr. RAHN. To answer the first part of your question, from every indication we get management does want to know, but management has little idea how to measure these things. We struggle with that at the chamber. I don't know how to measure the productivity of our productivity center. Day in and day out, we at the chamber are struggling with this essential problem. I feel like the science of productivity and maybe the whole science of economics is where medicine was in 1625.

Mr. LUNDINE. The comment that you made that there is a greater belief by management that workers will respond to greater inclusion of decisionmaking on the job juxtaposed to your 1979 survey, which I believe found 80 percent of workers, when asked, thought that they had ideas that could improve productivity on their own jobs, and your comment today that you have observed that small business has been less aggressive in implementing any of these programs—I don't care whether they are called quality circles or what they're called—leads me to the question: What are the impediments to the implementation of this idea of greater worker participation?

Or, what particularly can you identify—that can be done, not to tell small business what they ought to do, but just to provide information so maybe not only General Motors or Westinghouse or Hewlett-Packard or Motorola, which we've all had testimony from here, but smaller businesses might be able to implement more of these ideas.

Mr. RAHN. With the smaller business, of course, much is a problem of education. The small businessman—given that he tends to do so many different types of things himself has the problem of just not being able to acquire the types of information that he needs. And productivity being—to some degree—a vague esoteric subject is not something that is central to his day-to-day operations. When he's looking at the bottom line he is looking at immediate sales. And the typical small businessman does not have time to be reflective.

We find this in the whole other—a number of areas, including marketing, financial management, and so forth. Small businesses tend to be undermanaged in general.

Carl, I don't know if you have anything to add to that.

Mr. NOLLER. I think it's important to recognize with respect to these—quality circles or whatever you name them that there are two fundamental problems that ve y much get in the way. It's becoming increasingly clear to me that these quality cycles work—at least when they're properly implemented. It takes a lot of training.

But it changes very fundamental patterns of management behavior and labor behavior in this country. Over the past 50 years we have built a whole set of law based on adversarial relationship between business and labor. Now you have people coming along and saying—that people ought to get together and cooperate in proposing various methods for doing this.

I think it is quite clear that labor unions have been very concerned about this, even though it appears to be quite effective. The workers seem to like it—but it undermines the current rationale for a union's existence.

If you start with the assumption that there is an adversarial relationship, where workers need to be protected—that creates an intellectual basis for a labor union. But to concede that things can be set up in a cooperative way it undermines the whole mentality and the whole legal structure.

At the same time, management is used to operating in a different way which does not involve consultation. Apparently the biggest threat comes from middle management, because they are the ones who actually perceive that their positions are being undermined. Before they had authority, but what is my authority under this kind of an arrangement?

It takes a lot of reeducation. So I think it's important to recognize even though this system requires a lot of training—it appears to work, at least from what I've seen. Yet there are also some very real impediments of an attitudinal nature that get in the way.

Mr. LUNDINE. You've touched on three areas that I want to follow up on quickly. One is the small business.

One—just an observation—you know you really have less problems in implementing some of these kinds of ideas in small businesses than in large. GM had to go through an enormous assessment of its own corporate structure in determining how these things would work.

Of a small business of even 300 or 400 people, it's not hard for the chief executive officer as well as a diagonal slice of management at all levels to sit down with workers. They really are relating to one another more easily even before the introduction of this than in large businesses.

I really agree with you. It's a matter of getting information across, and anything that you could suggest we should do in that regard would be welcome.

The second thing I'd like to pick up on—is on the aspect of the people who are threatened. I could not agree with you any more. The only amendment I would make to what you said is it's firstline supervision management that is the most threatened. In a factory situation it's the foreman.

And the reason is very simple. It's because he's been used to saying, "Listen, do it that way and shut up because—you're going to do it that way because I say you're going to do it that way," and all of a sudden now we're asking him to listen, to be a catalyst, to develop team work, and that requires whole new skills.

In that connection I'd be interested in your further management ideas as this dialog continues of how much training are they doing of their own management before they enter into all these quality circles and these ideas? And particularly in intermediate and lower-level management.

Mr. RAHN. I am sure it varies enormously by firm. You find some firms doing a great deal—others practically none at all.

You were talking about what your committee can do, and here I guess I almost revert back to a basic libertarian position because I think this is one of these things that Congress can do relatively little about. You can only make sure, that you foster an environment which encourages innovation, removes artificial impediments, and so forth.

Competition over time is going to resolve this. The firms, the unions and their worker groups that are more progressive in terms of getting to the understanding of causes of productivity growth and finding ways to work together to make sure that both workers and management are on the same wave length and path—will succeed. Those firms and those unions which lag behind and end up with lower productivity growth will meet their fate, as determined by the market.

And, maybe it's almost fatalistic, but I don't really believe that there is a whole lot that Government can do. I think if you try to be too proactive here that you will be no more successful than a lot of other things that have failed. There is a limit to what we can do at the Chamber or say, the AFL-CIO can do, or other groups.

Mr. LUNDINE. Well, I don't want to challenge that—in fact I share that philosophic view. At the same time, you made the comment that all our laws are based on confrontation or adversarial relationship. What we probably ought to do, not just in the science and technological area, is review our own house to see that it isn't in disorder in terms of creating the kind of environment.

I was going to observe that the union steward is threatened. You know one very common and practical experience I have had is that a union steward in a sense has a stake in grievances because when grievances go down many of them have to work at their machines longer and they are not working on union business as long. And it's more fun to sit around and argue grievances than operate machines. And so in a way—like the foreman—it takes the steward of the union.

It is easy for the president of the union to go for these kinds of things and it's easy for the chief executives that you surveyed, but it's different when you get it down there at that level. And most problems in an industrial setting, where organized labor is involved, are actually solved one way or another by avoidance or by resolution between those firstline surervisors and firstline worker representatives.

It isn't something that I think there's a government panacea to, but I think we ought to look at getting our own house so that it's not in disarray, if people want to go ahead with this.

Mr. RAHN. I think a very hopeful sign is that both management and labor are increasingly aware of the need for productivity growth.

Particularly the so-called Japanese threat—has made everyone much more aware of this problem. We have illustration after illustration practically every day in the news of companies and unions and worker groups getting together to try to solve these problems. And I think that is the thing that is going to save us in the long run.

We are actually quite optimistic about our productivity projections for the next couple of years, and really for the entire decade.

Mr. LUNDINE. Well, by the late eighties, to some extent, the change in composition of the workforce that worked against us in the seventies will subside.

Mr. RAHN. The energy problems will be worked out, the demographics will be worked out, and there is obviously now an understanding in the Congress so the impediments to capital formation are being worked out.

Mr. LUNDINE. But it's in this area of the human factors that we have focused the least attention. And I'm not suggesting that we need a proactive government.

In that connection I'd just like to ask one more question. It was interesting to me that in your survey—and I don't mean this critically—you ask a bunch of Government people what's wrong with productivity and they'll point at business, and you ask business people and they'll point at Government—and you don't even need to include labor in that equation to get some finger pointing. And I'm not quarreling with their conclusions.

But you ask management what's wrong with productivity. Well, inflation is wrong with productivity, the lack of a tax structure and on and on—almost every one of the things that were at the top of your list as I recall were things that allegedly Government would have control over.

What I'd like to know from American business is what's management going to do about productivity? I think it is incumbent on Government to take a look at ourselves and say what are we doing? And not to just say we passed the tax bill and that's the end of that episode. Now we can turn our attention to social issues or something else.

But, did you get any flavor or from management what can you do to get the question back—all right, management, what are you going to do about productivity? Now you've got a tax bill, what are you going to do about it?

Mr. RAHN. Again, we've already found that a good number of firms are being much more active in productivity programs in terms of looking at, work forums, quality circles and so forth, and also having productivity executives as such.

But given the changes that have been made and are being made—in terms of tax impediments and regulations and so forth—if you take away a lot of the things that American business has been complaining about, then we will no longer have the excuse of saying, well the reason we are not growing is because of you, Congressman Lundine. We can't use that any more, or, hopefully, we won't be able to use that in the near future.

And it's much like the whole economic recovery program. At some point—hopefully—once we get the problem of monetary growth straightened out then it really is up to business in terms of capital investment and in terms of getting the economy moving again. Business does have the responsibility there, I think most businessmen are aware of that, and also it's just in their own self-interest.

If the impediments are taken away there is no reason why they cannot make a profit, and I think you will see that the overwhelming majority of American businesses operate in their own self-interest. But they will benefit all of society through increased capital investment, greater productivity growth, more employment, and so forth.

Mr. NOLLER. If you ask specifically though what you can do, I think there is something very important you can do to help this process along.

You can help both business and labor confront this issue directly.

One of the ways that Congress has helped to avoid that is to—allow bailouts for an industry here, protection for labor there—that kind of thing. That promotes irresponsibility.

Mr. LUNDINE. And then we also tell them how they have to go about achieving those particular goals in some cases.

I've taken a long time.

Mr. DYMALLY. Thank you very much, Mr. Chairman.

Dr. Rahn, I was about to publish your first release in my tabloid to give some balance as my tabloid is very prolabor. But when your colleague said he did a survey it made me a little bit insecure because I have problems with sampling, I have problems with biases in surveys. A survey about business, I would be biased against business. And in America we keep hearing about the worker being the cause of productivity problems. I thought it was rather refreshing that for a change the business community is being intellectually honest and saying: Look, fellows, we ought to look at ourselves.

I am not so sure that you will get out of your survey any prolabor attitude—proworker attitude. Because I think both labor and business in this country have a bias—an adversarial relationship toward each other—unlike the Japanese, where cooperation is embedded in their culture even though they work on the opposite sides of the fence.

So I have a little skepticism there.

The other point I want to raise—and it's probably a little partisan and I want you to forgive me—you talked about the tax program that we passed here. I was somewhat distressed at a chamber of commerce in my district because they weren't interested in a tax reduction; they were interested in the Reagan tax reduction.

There's a difference—whether you're interested in tax cuts, or whether you're interested in John Smith's tax cuts. And that distressed me very much. During the entire lobbying of me for the budget cuts they weren't interested in budget cuts, they were interested in the Reagan budget cuts. They took a very partisan slant, which was my first experience with that and I've been in the legislature some 20 years.

That was distressing, and I want you, as best you can, I know this is not your area—to just pass the word on to the chamber that Dymally expressed his unhappiness. And I will express it when I go back home in November and December.

I would have preferred them to come and say to me that we have two budget acts and I think this one is more favorable to our thinking. But there was no interest. I think that the Rostenkowski package was much better for them and for my district, but they weren't interested in that.

Mr. RAHN. I will be happy to address that.

Mr. DYMALLY. I'm laughing now because they want to abolish Wall Street. I mean, the President wants to abolish Wall Street. Now I think it's rather funny of him.

Mr. RAHN. Responding to the first part of your question, as far as the objectivity of the surveys—our goal here is to make our surveys as objective as possible. We work with the Gallup organization, and they are the ones who actually carry out most of the surveys for us though not specialized survey like the management attitudes survey. But in terms of our business confidence and consumer confidence surveys, we have worked with them very closely and tried to get objective questions, and as scientific a sampling as possible.

Of course it is possible to bias surveys, but that does us no good. We are here trying to determine the truth, as much as we can.

Mr. DYMALLY. I wasn't saying you were biased. I was just stating the employer on the one hand——

Mr. RAHN. I understand that.

So we try to work and compensate for that. If any of you have any suggestions, because we have an ongoing program here. We would be more than happy to listen to your suggestions.

Mr. DYMALLY. I would like to see the third part of this, being planned now for next year, take the form of a study, not a survey. I think a study, where you can really get in there and you watch the workers, is more objective. I would like to see a study done on that, because the VW people in West Germany said that the VW workers in Pennsylvania are as good as the West Germans, and in some instances better. And the Japanese are saying, "Hey, fellows, it's not your workers. I think your management system is a little screwy around here."

So the foreigners are saying the workers are just as good. The Sony plant in San Diego is producing so much that it is going into other States.

Mr. RAHN. Sony—but they have another problem. They have the unitary tax, which I will talk about, and we are trying to get rid of that.

Mr. DYMALLY. The Sony people are very, very impressed with the productivity of the San Diego workers. The West Germans are saying, "No, we don't think it's the workers." We have the Japanese speaking from their California experience saying, "No, we don't think it's the workers."

Mr. RAHN. Well, we'll be in the process of doing more studies, particularly of the Japanese experience in managing U.S. plants—it's something that's of great interest to us and to our management.

Mr. DYMALLY. I'd like to see you make a study on that rather than to survey.

Mr. RAHN. We'll be doing both.

Mr. DYMALLY. I get these surveys from Ph. D. candidates. I put all my biases in them. And then send them back.

Mr. RAHN. That's the trouble with the education structure. That's how we all got our Ph. D.'s.

But getting back to your tax and budget question. American business in general—the chamber, of course, is by far the world's largest business federation—totally endorsed the President's program. And you are basically arguing the businessmen took the simplistic approach when they'd go in and approach you.

We are all aware here that both the budget bills and the tax bills were enormously complex. We had a good number of people on our own staff that are working full time on both budget and taxes. And so essentially they were taking, in many ways, our recommendations. They hire us, in essence, to take our recommendations.

The typical businessman did not understand the budget bill in detail. In fact, I have to admit I got totally lost at points in the budget bill, and I wonder if anybody besides Dave Stockman fully understood it. The tax bill, too, was highly complex—we spent a lot of time with it. And we made a recommendation to the business community of what we thought was best. The budget cutbacks, in particular got into a lot of value judgments.

In terms of the tax impact and economic growth I was involved early, I was with the President's Tax Policy Task Force, and I would still defend that very much.

I think the Ways and Means Committee Bill was a superb bill, it was a great improvement over existing legislation. I still think the bipartisan bill was somewhat superior, we can debate this forever, but the reason business does that——

Mr. DYMALLY. My point was that——

Mr. RAHN. They don't have time to evaluate the bill in detail, though.

Mr. DYMALLY. My point was that the differences in the tax bill were so small that the chamber of commerce should have permitted the legislator to make up his mind rather than have to deal with this heavy Reagan push. I am referring to such a partisan approach that I have problems going to my chamber of commerce. I usually support the big business people—I am very prolabor, very liberal—but big in business in California. Every major "dog" issue that you had there I was fighting Jerry Brown. I was strictly chamber. So that distressed me. I would have preferred them to say, "Look, we want you to look at these. They are for cutbacks in spending and for tax reduction." But this heavy partisan push gave me the impression they were a subsidiary of the RNC.

Mr. RAHN. It wasn't strictly partisan. It was mainly pragmatic. We did the evaluation, and I still think that the bipartisan tax bill was a substantial improvement over the Ways and Means bill. The Ways and Means bill was a very good bill. I will not dispute that.

But we felt we had to keep the momentum going; I think our members understood that. Let's assume for a minute that the bills had been equal in terms of content. It's not something I will concede, but let's assume that. But we know how the press would have portrayed it—as a defeat for the President's program, for supply-side economics, and so forth. I think that would have been a step backwards; I think it would have been much more difficult in the future to enact the additional changes. That we still have to complete. That is why we took our strong stance.

The chamber is a bipartisan organization, we have endorsed a number of Democrats. Clearly we've endorsed more Republicans in our opportunity races. Over time we hope that we'll be able to have a more even distribution of the candidates we endorse from both parties.

Mr. **Dymally**. Mr. Chairman, I know we have to go vote, but I hope there is some connection between our discussion here and productivity and innovation.

Mr. **Rahn**. I was contemplating that. Thank you very much.

Mr. **Lundine**. I think what Mr. Rahn is saying in a way, that you believe that attitudes have significant impact, even on capital investment.

Mr. **Rahn**. Surely.

Mr. **Lundine**. Thank you very much for your testimony.

[The prepared statement of Richard W. Rahn follows:]

STATEMENT
on
MANAGEMENT EFFORTS TO PROMOTE INNOVATION AND
PRODUCTIVITY: THE RESULTS OF U.S. CHAMBER SURVEYS
before the
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
for the
CHAMBER OF COMMERCE OF THE UNITED STATES
by
Dr. Richard W. Rahn
September 17, 1981

I am Richard W. Rahn, Vice President and Chief Economist of the Chamber of Commerce of the United States. The U.S. Chamber is the world's largest business federation comprised of more than 170,000 businesses, Chambers of Commerce in the United States and abroad, trade and professional associations, and individuals. On behalf of our members, I welcome this opportunity to share with you the objectives and programs of the Chamber's Productivity Center, as well as the findings from one specific project -- our Management Attitudes Toward Productivity survey.

SUMMARY

The U.S. Chamber's Productivity Center functions to influence public policy and serves as a clearinghouse for information. Among other things, it has produced a critically acclaimed booklet, "Productivity, People, and Public Policy," and expects to oversee productivity tours of Japan.

Results from the Center's Management Attitudes Toward Productivity survey form the basis for our testimony today.

Principle findings are that the American business leadership is in general agreement with economic researchers concerning the causes for our productivity slowdown.

The survey shows progress toward a productivity commitment, especially by large firms. Management attitudes support more innovative initiatives to spur productivity, and some firms have undertaken them already. Clearly, the ground work is being prepared for greater experimentation in the future.

PRODUCTIVITY CENTER: OBJECTIVES AND PROGRAM

Reflecting the Chamber's unique communications strength, nationwide grass roots network, and Washington location, the Center's principle effort is to influence public policy that affects our Nation's productivity. Focusing on taxes, regulation, and issues of economic stability, we have presented Chamber positions before both Houses of Congress. We exchange viewpoints personally with interested Members on both sides of the aisle and regularly supply them with written material, as well.

The Center seeks opportunities through the news media to convey its message on the Nation's serious productivity problem. Center staff have appeared on television and radio and have been interviewed for press purposes across the country.

The Productivity Center provides basic research and analysis in evaluating legislation. Dr. Carl W. Noller, the Center's Director, provided support for the relationship between investment, savings, productivity, and personal tax cuts by focusing on the previously unexplored experience of New York State with Kemp-Roth-like tax reductions. He reported the unexpectedly favorable economic responses in a paper, "The New York State Experience with Personal Income Tax Cuts". Another paper related capital cost recovery to productivity, while a third piece highlighted the relationship between business illiquidity and productivity. All were used to support the President's tax reform package and were circulated in the Executive Branch and on Capitol Hill.

The Chamber recognizes, however, that changes in government policy alone will not solve the nation's productivity problem. Consequently, its Center is devising conferences, publications, programs, and research projects that will encourage management and labor to make a more active and effective productivity effort.

To this end, the American Productivity Center and the U.S. Chamber of Commerce joined to cosponsor a conference, "Productivity: The Key to Revitalizing America", on June 30, 1981 in Atlanta, Georgia. At this conference, the U.S. Chamber introduced its new publication, "Productivity, People, and Public Policy", which defines the dimensions of the problem, provides extensive data on the issue, and suggests obstacles to productivity growth that government can remove -- all in an understandable and attractive format. It has received favorable comment from John Kendrick and J.R. Norsworthy, two respected productivity researchers, and we understand it will be required reading for all members of the National Productivity Advisory Council.[1]

Because the Japanese have made great strides in improving productivity, Americans should know more about developments there. As a result, work has begun -- in conjunction with the Japan Productivity Center -- on four projected tours of Japan. Each tour will focus on a different aspect of productivity in which the Japanese have made unique contributions. Participants will receive orientation by Americans in Japan, tour Japanese facilities, and prepare a report detailing what they have seen and how it can be applied in the U.S. The program should begin early in 1982. On still another front, the Center is seeking funding for several research projects that will fill important gaps in our knowledge of the productivity issue.

The results of another Center project bear on the human factor as it relates to innovation and productivity -- the subject of these hearings. We know that management perceptions of the productivity problem and its solution will be reflected in the actions they take. A highly successful survey, Workers' Attitudes Toward Productivity, sheds light on worker viewpoints. Recently, we conducted a similar poll of American management. In conjunction with the Chamber's Survey Research Center, a questionnaire on productivity attitudes was included in the quarterly survey of business executives' attitudes taken during January-February, 1981. The quarterly survey is sent to a scientific sample of 1,870 top executives, representing a cross-section of U.S. business by industry, size of firm, and location. We received 1,083 replies -- more than enough for a valid survey. Consequently, we believe that our results reflect the actual opinions held by America's business leadership, with only a small margin of possible error.

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[1] John Kendrick is professor of economics at George Washington University; J.R. Norsworthy is chief of the Division of Productivity Research, Bureau of Labor Statistics.

In this survey, we wanted to see not only how the American business community perceived productivity, but also whether these views had changed from previous surveys and how they related to worker attitudes. In addition, we wanted to determine what similarities and differences exist with econometric test results on why productivity growth has slowed.

My presentation begins with management views concerning the causes of our productivity slowdown and how these compare with economic findings. But first, some background material should be helpful.

CHAMBER SURVEYS AND ECONOMIC STUDIES: COMPARISONS AND CONTRASTS IN EXPLAINING PRODUCTIVITY PERFORMANCE

Productivity performance became a pressing concern only within the last decade. Though U.S. productivity growth trailed major international competitors through the 1960's, our average annual increase since World War II had been a respectable 3.2%. Furthermore, such progress was expected to continue. As a result, neither academic attention nor opinion surveys focused heavily on this issue. Very few studies even existed before 1970.

A less complacent attitude resulted from the disappointing productivity gains of the 1970's. There were two distinct declines -- to 2.2% for 1969-1973 and a precipitous slump to 0.6% from 1974-1980. Taken as a whole, average annual productivity growth was just 1.3% during the period 1969-1980. Productivity growth was negative in 1978, 1979, and 1980 -- the first time this has happened since data collection began in 1909. While a temporary negative growth might be understandable in recession periods, it is very unusual to experience negative growth rates during a recovery.

This worrisome trend led economists to study the problem, and a rich literature began developing by the mid-1970's. Seminal works include John Kendrick's Postwar Productivity Trends in the United States, 1948-1969 (1973) and two publications by Edward Denison: Accounting for United States Economic Growth, 1948-1969 (1974) and Accounting for Slower Economic Growth (1979).[2]

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[2] Edward Denison is a senior fellow emeritus of the Brookings Institution and Associate Director of the Bureau of Economic Analysis, U.S. Department of Commerce.

Other noteworthy contributors include Dale Jorgenson (Harvard University) -- working with various collaborators over the years -- J.R. Norsworthy (Bureau of Labor Statistics), and Robin Siegel (Data Resources, Inc.). Although these researchers and others do not always agree on the importance of a given factor nor the magnitude of its significance, it is nonetheless possible to distill common elements from this literature.

Like researchers, the business community has its perceptions of causes and cures for the disappointing productivity growth rate. The Survey Research Center of the U.S. Chamber of Commerce first polled management for an explanation of the productivity slowdown in the summer of 1978. The inquiry was repeated in the fall of 1980. These findings are presented in Chart 1, along with results from our 1979 Workers' Attitudes survey. While the current survey does not specifically ask about causes of slow productivity growth, management attitudes on causes are reflected in survey questions 1 and 4, which inquire about solutions. In the material that follows, comparisons and contrasts are drawn between what managers and workers believe and what scholars have concluded.

Federal Government Regulations

By a substantial margin, management respondents in previous surveys identified federal regulation as a major cause of the productivity downturn. Answers to questions 1 and 4 of this survey suggest a similar perception. Workers, however, ranked federal regulations sixth among their causes.

There is a consensus among researchers that the dramatic growth in federal regulation during the 1970's has had an adverse impact on productivity. Plant and equipment were modified, replaced, or downrated to accommodate pollution control, workplace safety, and health mandates. The total cost of all regulation in one year (1980) has been estimated at $126 billion. Little additional output resulted from this expense. Yet, economists would not rank government regulation so highly on the scale of anti-productivity culprits. Most find that the increasing regulatory burden has accounted for 10-15% of our total decline, which translates into about a 0.3% reduction in productivity growth per year. Thus, the business community

CHART 1
BUSINESS AND WORKER ATTITUDES CONCERNING CAUSES OF THE SLOWDOWN IN PRODUCTIVITY GROWTH

(percent of respondents answering very important and important)

	Business				Worker	
	Summer 1978		Fall 1980		Fall 1979	
Causes	Percent	Rank	Percent	Rank	Percent	Rank
Federal Government Regulations	95	1	96	1	12	6
General Climate for Business	86	2	82	4	NA	-
Worker Attitudes	83	3	87	3	53	1
Welfare, Unemployment, and Other Income Security Benefits	81	4	76	6	NA	-
State Government Regulations	78	5	79	5	NA	-
Inadequate Plant and Equipment Investment	74	6	88	2	9	8
Labor Union Activity	73	7	69	8	10	7
Capital Gains Taxes	68	8	69	8	NA	-
Inadequate Research and Development Spending	63	9	79	5	18	5
Corporate Income Taxes	62	10	69	8	NA	-
Management Attitudes	62	10	71	7	37	2
Skill Level of Workers	59	11	65	9	NA	-
Energy Cost or Availability	59	11	63	10	NA	-
Personal Income Taxes	54	12	57	11	NA	-
Local Government Regulations	54	12	51	12	NA	-
Quality of Tools and Equipment	NA		NA		21	3
Supervisor Attitudes and Abilities	NA		NA		21	3
Availability and Use of Computers	NA		NA		6	9

NA = denotes a choice not available in a survey.

Source: Business Confidence Survey, A Chamber /Gallup Survey, July-August 1978; Workers' Attitudes Toward Productivity, A Chamber/Gallup Survey, October-November 1979; Business Confidence Survey, Survey Research Center, U.S. Chamber, October-November 1980.

and the academic community agree that regulation has been a problem, but seem to disagree on its importance relative to other causes.[3]

General Business Climate

Respondents to the 1978 and 1980 surveys cited the general climate of business as an important factor contributing to lower productivity growth. Since the phrase "general climate of business" is somewhat ambiguous, one cannot know precisely what these answers reflect. Reasonable assumptions, however, would include the impact of inflation and fluctuations in the business cycle. Though the current survey does not pose a question in terms of the "general climate of business", it does show strong feeling that inflation is a source of productivity problems. This choice was not posed in the worker's survey.

Several economists have suggested that inflation plays an important role. Marvin Kosters (American Enterprise Institute) believes that inflation may be the greatest single cause of our slow productivity growth, and Burton Malkiel (Princeton) has stressed inflation also. Economic theory supports this view. Inflation creates a set of incentives that work against productivity. Changing prices make the long-term planning needed to evaluate investment and research and development projects more difficult. Inflation creates artifical profits from under-depreciation and inventory under-valuation, which results in higher tax bills. These deceptively high accounting profits mask the reality of falling cash flow and greater illiquidity. Inflation also encourages consumption and debt, rather than the investment and saving needed to spur productivity. Yet, econometric studies have failed to demonstrate a significant link between inflation and productivity. This is not altogether surprising. Given its many subtle impacts, inflation is not an easy variable to test. Other factors under study may be capturing some of these impacts, as well.

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[3] Businessmen rank state government regulations as the fifth most frequently cited cause for the slowdown in both previous surveys. No academic study has been found that tests this variable, nor is it mentioned anywhere in the literature.

Econometric studies clearly show that cyclical effects influence productivity. Perhaps 20-30% of the productivity slowdown is accounted for by strikes, unfavorable weather, and business fluctuations. Productivity evidences a pronounced pro-cyclical tendency, falling during the downswing and rising during the upturn. This results, in part, because output is more easily adjusted than the workforce. During the contraction phase of the cycle, employers are reluctant to lay off workers, because they may be difficult to replace once business increases. Thus, output falls faster than hours worked, leading to a sharp drop in productivity. With the expansion phase, the process reverses. For a time, as new orders come in, output can rise without adding many hours worked. Changes in demand also create economies and diseconomies of scale that influence productivity, as well. Consequently, the more frequent and pronounced cycles of the 1970's had a dampening effect on productivity.

Work Force Attitudes

Surveys show that American businessmen place considerable importance on employee attitudes. Both earlier Chamber surveys reveal that top management cited worker attitudes, making them the third most frequently mentioned impediment. Managers also blamed welfare, unemployment, and other income security benefits for productivity problems, presumably because benefit levels were eroding the willingness to work. They were more charitable about their own attitudes, though by the fall of 1980, management attitudes was the seventh most frequently mentioned cause of low productivity. These results are largely corroborated by the responses to question 4 of this survey and the findings of the Congressional Task Force on Industrial Innovation, chaired by Representative AuCoin. American businessmen see workers and supervisors as being much more culpable than themselves.

Surprisingly, American workers placed a very heavy emphasis on workplace attitudes in explaining slow productivity growth. Fifty-three percent of the respondents saw changes in worker attitudes and abilities as making a large improvement in productivity. This ranked highest among the nine available choices. Workers saw room for improvement in the attitudes and abilities of managers and supervisors, as well. Thirty-seven percent cited managers, while 21 percent felt more could be done by supervisors.

Economists have not given much credence to changes in employee attitudes. This may stem from their limited contact with the work force at any level. Doubtless, too, the difficulty in quantifying attitudes for purposes of statistical testing has been a problem. Whatever the reasons, none of the surveyed studies had tested for this influence.

Capital Investment, Research and Development

Business views respecting the importance of capital investment and research and development to the productivity slowdown changed dramatically between the summer of 1978 and the fall of 1980. Inadequate capital investment jumped from sixth to second in the ranking of causes; 88% mentioned this as a problem, up from 74% in 1978. Inadequate research and development spending moved from ninth to fifth place, mentioned by 79% of the respondents versus 63% in 1978. The current survey corroborates these results as regards plant and equipment investment, but not R&D. Of seven possible choices, changes in the company R&D program was checked least as a source of improved productivity. Workers, however, saw lack of innovation as a greater problem then inadequate investment.

In contrast, statistical studies show that insufficient net business fixed investment and R&D spending are both significant parts of the problem. The net addition to U.S. plant and equipment -- after replacing depreciated units -- has fallen. Whereas we were adding to our net capital stock at a 4.5% annual rate from 1948-1968, we let that slip to a 3.6% rate during the 1970's. But this lower figure is itself an overstatement. It includes significant amounts of legally mandated investment which do not increase, and may even reduce, productivity. Environmental, health, and safety expenditures are the most important examples. Net new investment is no longer sufficient to lower the average age of plant and equipment. Both plant and equipment have been aging since 1974, something we last experienced during the Great Depression. The amount of capital relative to our workforce also has declined each year since 1976. From 1947 to 1975, this ratio had declined only twice. We also are trailing all of our major trade competitors in capital investment relative to GNP. Because advances in technology largely enter the production process through new capital investment, a slowdown in business investment implies that we are not fully utilizing the technology available to us. Most findings conclude that inadequate investment accounts for perhaps 20% of the problem, though one Denison study showed only a small impact.

Civilian R&D expenditures have not expanded as a percentage of GNP during the 1970's, unlike previous decades. Some expenditures, too, are regulation induced -- involved in retesting and reproving existing products. Thus, R&D captures an additional 10% of the problem, as shown in studies by Kendrick, Denison, Norsworthy, and Michael Evans (Evans Economics, Inc.).

Energy

One area of substantial disagreement between businessmen and academics is over the impact of energy prices on productivity. Previous surveys show that energy was ranked very low by the business community. The current survey does not touch on this matter, nor did the worker attitudes survey. Economists, however, widely believe that soaring energy prices since 1973 are a major factor. This conclusion is supported by the simultaneous and worldwide decline in productivity growth rates after 1973. Energy price increases affect productivity primarily through the capital stock. Soaring prices made some energy intensive plant and equipment obsolete immediately and greatly shortened the useful life of other such assets. Studies by Siegel and Evans have both tested this variable and found it highly significant.

Taxation

The worker attitudes survey did not ask about the role of taxes, but our surveys of the business community have raised this issue. A solid majority of businessmen see various taxes as major impediments to productivity. The capital gains tax alone ranked eighth in both previous surveys, while the corporate and personal income taxes also were often cited. The current survey corroborates these results. The corporate and capital gains taxes are frequently mentioned but no specific tax ranks so highly as workers' attitudes or inflation in the rating of current concerns. It is likely, however, that taxation would have rated at or near the very top of the list had the choice been simply "taxation," rather than a selection from among several specific taxes.

Researchers have not given taxes a priority in terms of testing. This is surprising, since taxes affect productivity -- impacting on investment, saving, and work effort. Clearly, more work needs to be done in testing tax variables.

Other Factors

Researchers have uncovered several other factors explaining a portion of the productivity problem on which businessmen and workers do not focus. Until the 1970's, productivity benefitted by a shift of workers from farming and self-employment toward manufacturing and service sector employment. While farm productivity has risen rapidly, it began from a lower base. Hence, any movement of workers from farming to other sectors raised productivity. Shifts out of self-employment had the same effect. These movements are estimated to have raised productivity by 0.3 to 0.5% per year in the early postwar years. These shifts had largely run their course by the late 1960's.

Another factor that economists believe may be depressing our productivity growth is the huge influx of new workers in the late 1960's and 1970's -- reflecting the postwar baby boom and increasing female participation. Because these workers had little experience, their productivity was below average and hence depressed overall performance. Testing this variable has led to a wide range of results. A preponderance of opinion concludes that 15-20% of the slowdown stemmed from this cause. During the 1980's, however, changing labor composition should be a positive factor, as new entrants become fully integrated into the work force.

Conclusion

Managers and researchers are in general agreement concerning the causes for our productivity slowdown. Both groups point to the general business climate, federal regulation, and capital investment as contributory factors, though the degree of emphasis may differ. Economists also point to structural shifts and changing composition of the labor force; their work experience would not lead businessmen or workers to focus on these. Improved economic testing procedures may reduce some of these discrepancies. Nonetheless, it appears that each group has insights that could benefit the other in more completely understanding the causes of productivity decline.

RESPONSES TO THE PERCEIVED SLOWDOWN IN PRODUCTIVITY GROWTH

While perceptions of the productivity problem are important, our survey also sought to determine what specific strategies and actions American managers were taking to improve productivity and encourage innovation.

We assumed that one indication of a company's commitment to improve productivity would be the existence of a person or staff "whose primary responsibility is to develop ways and means to improve productivity". Using this crude measure, we found that 46% of the firms surveyed had at least one person performing these duties, while 48% did not; 6% gave no response. We also found very little difference in the proportion of large firms -- those with 500 employees or more -- and small firms having this capability. Furthermore, personnel in these positions generally had access to top management. They reported to the Chief Executive Office, the Vice President of Manufacturing, or his equivalent in more than three-fourths of the firms, which suggests that the productivity personnel have some impact.

We felt that a firm making a serious productivity effort would probably design its compensation package to motivate employees. This belief was reinforced by a finding from the Chamber's Workers' Attitudes Toward Productivity survey. When asked for "the most effective way to encourage people to come up with good ideas to improve performance of the organization or company", a large plurality chose monetary reward, and a significant number were motivated by promotion. As Chart 2 shows, however, management placed heavy emphasis on personal recognition and almost none on promotion.

When we asked "what three features are most important in the design of your company's compensation package", just over one-half of the respondents indicated that productivity incentives played a role. But, as Chart 3

CHART 2
MANAGEMENT AND WORKER VIEWS ON REWARDS TO IMPROVE PERFORMANCE AND INCREASE MOTIVATION
(percent of respondents finding a choice effective)

Reward	Management	Worker
Monetary Reward	33	41
Personal Recognition	51	26
Promotion	6	26
Greater Job Security	3	NA
Other	NA	3
No Response	7	3

NA = An option not available in the survey.

Source: Management Attitudes Toward Productivity, January - February, 1981.

indicates, compensation packages are more strongly influenced by the desires to stay competitive in the labor market and reward outstanding performance. The chart also shows responses to our inquiry about whether firms use devices which tie compensation and other decision-making to actual performance. The answers indicated that profit sharing, stock options and bonuses related to productivity or quality of work are well accepted. It is not clear, however, as to whether these benefits are widely available or restricted to just a few employees. More innovative methods -- like productivity gain-sharing (the Scanlon Plan, etc.), quality circles, and investment efficiency ratios -- have made much smaller impacts.

The results show that almost one firm in five employs none of these devices. Furthermore, large firms apparently have a greater productivity orientation than small firms -- those with less than 500 employees. Their compensation policies stress productivity and performance more than the small firms, which place a relatively greater stress on rewarding loyalty and relating payroll to company earnings. Also, a greater proportion of large firms have adopted each of the various innovative methods that promote productivity. Only one respondent in seven of the large firms had tried none of the techniques we listed. Among small firms, nearly one in four was not currently utilizing any of these techniques.

CHART 3
BUSINESS APPROACHES TO PRODUCTIVITY AND MOTIVATION
(percent of respondents)

	Three Features Important in Your Compensation Package		
Features	Total Business	Small Firms	Large Firms
Staying competitive in the labor market	77	65	85
Rewarding loyalty	15	24	10
Rewarding outstanding performance	70	54	79
Reducing employee turnover	29	32	26
Providing incentives for increased productivity	52	47	55
Keeping total payroll in line with company earnings	31	44	25
	Devices Actually Used to Improve Productivity		
Devices	Total Business	Small Firms	Large Firms
Productivity gain-sharing plans	13	10	15
Quality circles	14	5	19
Profit sharing or stock options (ESOP)	52	40	59
Investment efficiency ratios	1	*	2
Bonuses related to productivity or quality of work	56	51	59
None of the above	18	23	15

*Less than 1%

Source: Management Attitudes Toward Productivity, January - February, 1981.

Another possible indicator of serious productivity concern is the extent to which unionized companies made productivity an issue in their contract negotiations. So, we asked only executives in unionized companies to answer the question, which halved the size of our sample. Of those answering, only 16% indicated that productivity-related issues had been "very important" in their last negotiations; 31% said they were "somewhat important"; and 53% dismissed them as "not very important". Again, large unionized firms paid more attention to productivity in their union negotiations than did small firms.

Finally, questions were posed to indicate the extent to which American management accepts the premises of the Quality of Worklife Movement. Quality of Worklife is a general term covering several different approaches, which have the common feature of expanding employee responsibilities and consultation. Much has been written about one approach, quality circles. This device is quite successful in stimulating productivity gains, when properly implemented. Available evidence suggests that employees like the results. Our own Workers' Attitudes Toward Productivity showed that 60% of the workers wanted to be "more involved in efforts to get people to do their best on the job". Only 24% desired not to be involved. The remaining 16% saw themselves as being enough involved, prefered less involvement, or didn't know. This indicates a receptivity to such approaches.

Management, too, is supportive of the concept, according to our current survey. Seventy-nine percent of the respondents see workers working at least somewhat harder "if workers are involved and take part in making decisions that affect their jobs". Fifteen percent suspect there would be little effect, while 6% feel performance would decline or simply didn't know what to expect. Yet, Chart 3 shows that just one firm in seven is implementing quality circles. This finding is indirectly corroborated by worker responses indicating that, for the year preceding their questioning, 55% had received no in-house training and 65% did not participate in training put on by others. Because employee training is a prerequisite to a properly implemented quality circle program, these results confirm that such programs cannot be widespread.

CONCLUSION

When we take all of our findings, we conclude that management attitudes concerning slow productivity growth are changing. Though they still see federal regulations and worker attitudes as major obstacles, increasing numbers of top executives acknowledge greater management responsibility for the Nation's poor productivity showing in recent years. The survey also detected a widespread belief that workers will respond to greater involvement in decision-making on the job. Some firms have begun to align their policies with these perceptions -- altering compensation packages, introducing productivity into union negotiations, creating positions responsible for productivity, and trying some new approaches, like quality circles. At the same time, many firms -- and especially small businesses -- appear not to acknowledge the problem or do not know how to resolve it. In part, this is understandable. Right now, in addition to expanding capital investment, there are hundreds of methods, each claiming to be something of a panacea. Over time, we will come to know better what works. The Chamber's Productivity Center expects to play a role in the process -- expanding the frontiers of knowledge, disseminating information, and encouraging firms to be innovative.

Mr. LUNDINE. We are now going to have to adjourn for about 10 minutes to catch this vote. We will return for the testimony of Mr. Wada, the vice president of Sony Corp. and we can learn firsthand about those Sony experiences.

[Recess.]

Mr. LUNDINE. The committee will resume.

We will be pleased to have the testimony of Chris Wada, the assistant vice president of Sony Corp. of America.

Please proceed.

We have your written testimony. The entire written testimony will be made a part of the record. If you can summarize we'd appreciate it.

STATEMENT OF SADAMI (CHRIS) WADA, ASSISTANT VICE PRESIDENT, SONY CORP. OF AMERICA

Mr. WADA. Mr. Chairman and members of the committee, Sony really appreciates the opportunity to speak at this hearing. We'd like to be a good citizen, we'd like to be contributing as much as we can.

I personally place very high value upon the human factor and I will try to show what is the Japanese human factor, its limitation and what kind of human factor I see in the United States through our experiences.

We have very positive findings as reported in my earlier testimony on "Productivity per Sony's Experiences"—made before the Joint Economic Committee on May 1, 1981.

Family is the most important and influential unit in Japan. Family is probably the most basic and natural bondage—stronger than any other relationship.

The father is responsible for the behavior of his children. The head of the family is also responsible to the ancestors of the family. None is ever allowed to disgrace and shame the name of the family. If ever one does so, under certain circumstances, the one may be disowned and his tie with the family may be cut.

Pride, shame, loyalty, dedication, obedience, responsibility of the head of a family, order of authority and other principles have become part of our life in Japan.

As well explained in the book entitled "Japanese Society," written by Chie Nakane we develop strong vertical relationships.

We place far greater importance to our relationship to those above and those under. For that reason we develop different expressions for different vertical relationships. Its command is very important and if you violate it you would be considered ill-mannered and you may not be accepted by the community.

The head of the family is expected and obligated to fight for the members' welfare and happiness and unless a member does an absolutely inexcusable and disgraceful act no member will be severed of his tie with the family.

This relationship goes into the management-employee relationship. The head cannot sever his tie with those employees who selected the company, to have lifetime bondage of dedication, loyalty, pride and honor. It is strongly the responsibility of management to steer the course of the business as if one is planning the growth and happiness of the honorable family and its members.

In this context we are working not simply for money alone but for the similar kind of relationship we have in our family life. It is almost uncomfortable and even insecure for us not to have this kind of relationship.

We can depend on the rule that a person once hired and promised dedication to the company, the person will not be laid off or discharged.

It is a common practice in Japan to ask your boss to act as an official go-between when you have found someone you would like to marry.

Also in Japan we have what we call family allowances. When you are married there will be some allowance for it. The same goes when you have a child.

For those who commute from far away the company provides a transportation allowance. Often the company purchases commuter passes for employees.

Housing allowance is also valuable since housing is so expensive in Japan.

This cultural heritage surely helps productivity through dedication and loyalty rendered in exchange for genuine concern and care by the responsible head. We need two qualities here. One must by nature find joy in good results and delight in the benefit the organization draws from such good results. It is most critical if the worker is apathetic about the outcome. This cannot happen in our closely knit vertical human relations. All these things underlie our lifetime employment.

It would be a mistake if anyone thinks that this type of relationship cannot be developed in the United States where society is freer and people value frank and straightforward relationships because we find such a genuinely interested vertical relationship at many successful U.S. companies.

Sony is very glad to say that we seem to be among them. Thomas Watson, Jr. of IBM said:

> Along with the wages and job security, we have always thought it equally important that the company respect the dignity of its employees. People, as I have said, occupy more IBM management time than our products.

In the United States certain very humanistic leaders of business who are almost breaking away from the ordinary management practice of "hire and lay-off" insist upon their conviction in the humanistic management approach. The result is so evident in the high morale of their employees. I see no need for the idea of transferring Japanese management style to the United States.

The United States has its own management style with human values developed by leaders of business who believe in such values. This management style with strong interest in human values seems to be consistent with the Western culture developed by its religions—to be thankful, to love one another, to serve others, to give, to wish happiness for others, and to be kind to others—seems to me ways of Western religions.

This is the complete opposite of adversarial attitude. Where those human values bond the management and the employees, you have similar and genuine cooperation in spirit, ready for efforts for successful productivity growth and innovation.

We have been taught to respect the elders, to honor and not to disgrace your family, school, company or country, to be thankful for whatever you have, to consider dedication and sacrifice of great moral value and to think least of the worldly desire for money and material luxury. But all these values are absolute rather than religious-based, as in the Western World.

We are, comparatively speaking, emotional about these values, to the extent people could commit even suicide or hara-kiri when one mortally disgraces one's family or organization.

Japanese and Americans may act the same and, yet, each basis is different. And, even though, controlled and tempered, Japanese may be feeling more emotional than on the surface.

We both have a solid basis to be concerned and dedicated for the good result in productivity growth and innovation. If these values are felt strongly enough by both the management and the employees, then care and concern by the management will result in dedication and loyalty by the employees.

The Japanese are very much in harmony in vertical relationships, but in horizontal relationships each compete fiercely.

We know very well what would be the fate of those whose company fails and goes bankrupt. In the middle of your career you join another company. It is a humiliating experience for all the employees. Therefore, everyone gives his best effort to keep his company strong in competition and give their dedication to the company. The management feels a tremendous amount of moral obligation to lead the company in the right direction.

In the United States we see more competition in vertical relationships between management and employees, the Government and the business, teachers and the students, or even parents and children in some instances. Of course we are having more and more similar problems in Japan.

The competition sometimes takes the form of adversarial confrontation.

Adversarial relationship must be replaced by the spirit of respect, care, concern, dedication, and cooperation. Other material things being equal, such spirit will surely result in greater productivity.

I reported many things we do at our U.S. plants to achieve harmony and the spirit of family among all people in my testimony of May 1, 1981, before the Joint Economic Committee.

The Japanese have not been uniquely innovative except that our team efforts have created many innovative improvements on basic new ideas. Considering all the great and the unique innovations that have been made by extraordinary independent individuals I am very skeptical about Japan's ability to come out with completely unique inventions.

Sony's innovations have come from its inventive management who provides assurance and security for long-range research. For example, the successful Trinitron color television is the result of research done over a period of several years that was supported by Sony's top management at the cost of several hundred thousand dollars each year just for the Trinitron research. Stable and long-range assurance is very important in creating an atmosphere for inventiveness.

Innovation we need today depends on cooperative team efforts and in that regard vertical adversarial relationships should be replaced by a cooperative and harmonious one. I believe a greater emphasis upon human factor is imperative. Money cannot buy dedication and loyalty.

In conclusion, I would like to say that the productivity growth of industries in this country can be improved once the top management decides to show with determination their concern toward the members of the family; namely, employees of the company.

We may not easily produce the kind of innovations that great inventories of the Western world have made, but group efforts of a concerted spirit will push innovative progress forward faster than by teams of adversarial attitude.

The human factor is far less emphasized than it deserves. Sony's emphasis upon the human factor in our U.S. plants has proven to be very successful, and we are very satisfied with the American worker.

I agree that we need a faster depreciation, tax credit, cheaper funds, modernized and numerically controlled machines, but none of these help if people have low morale or poor dedication. Money cannot buy it. It must be earned.

Therefore, I urge that we pay much more attention to the human factor so that we have pride, trust, the spirit of cooperation for greater productivity growth and innovations.

Thank you.

[The prepared statement of Sadami (Chris) Wada follows:]

THE HUMAN FACTOR IN INNOVATION AND PRODUCTIVITY

By

Sadami (Chris) Wada
Assistant Vice President
Sony Corporation of America

Before the

Subcommittee on Science, Research and Technology
of the
House Committee on Science and Technology

September 17, 1981
Washington, D.C.

Mr. Chairman and members of the Committee on Science and Technology, I appreciate your invitation to appear at the hearing. I would like to do my best to make my testimony useful for your purpose.

Preface

I strongly believe in the human factor in innovation and productivity. I believe it is particularly important today. You could have all the money and material you need, and, yet, you could have no meaningful innovation or competitive productivity. Talent for unique innovation seems to be difficult to find in Japan while Leonard da Vinci, Nicolaus Copernicus, Thomas Edison or Alexander Graham Bell were all born in the Western world. Scholars have tried to reason why. Today we talk so much about productivity growth. The U.S. has the highest productivity per capita but its growth is slower than that in Japan in comparison. The human factor has an important role in it. Certainly, the human factor is one of the many factors, but it is most critical. You can turn an adverse situation into your favor. It is determined effort of people to overcome such an adverse situation by imagination as implied by the saying "necessity is the mother of invention". I personally place a very high value upon the human factor and I will try to show what is the Japanese human factor, its limitation and what kind of human factor I see in the United States through our experiences. We have very positive findings as reported in my earlier testimony on "Productivity per Sony's Experiences" made before the Joint Economic Committee on May 1, 1981.

1. Family

Family is the most important and influencial unit in Japan. Traditionally, three generation starting with grandparents to their grandchild live together. In this family unit, we have strict ethics of respect to elders. You are not allowed to argue against the elders. The grandfather has the greatest authority in the family. The head of the family has the great responsibility to feed and care for the family. Authority and power vested with the head demands his dedication and leadership for the family.

This basic relationship is probably the most basic and natural bondage stronger than any other relationship. The father is responsible for the behavior of his children. This sentiment runs strong and deep among Japanese. We are not talking about any legal responsibility here. We are talking about the social and ethical responsibility of the head of the family. The head of the family is also responsible to the ancestors of the family. None is ever allowed to disgrace and shame the name of the family. If ever one does so, under certain circumstances, the one may be disowned and his tie with the family may be severed.

He would be regarded by all others as a shameful and disgraceful person, and may not be able to continue to have the same welcome treatment in the immediate community. This being the tradition and customs of Japanese, we have very strong principles or codes that dictate our behavior suitable for the most harmonious and organized activities. Pride, shame, loyalty, dedication, obedience, responsibility of the head of a family, order of authority and other principles have become part of our life. You must understand our culture if you want to master our language because there are different words for the same thing. There are many ways to say "I". You have to select the right "I" depending upon whom you are talking to. You must be sensitive to your vertical relationship to the one you are talking to. It dictates whether or not you have to use a humble expression or a casual or even somewhat an arrogant expression to say "I".

As well explained in the book entitled, Japanese Society written by Chie Nakane*, we develop strong vertical relationships. We place far greater importance to our relationship to those above and those under. For that reason, we develop different expressions for different vertical relationships. Its command is very important and if you violate it, you would be considered ill-mannered and you may not be accepted by the community.

The head of the family is expected and obligated to fight for the members' welfare and happiness and unless a member does an absolutely inexcuseable and disgraceful act, no member will be severed of his tie with the family. This relationship goes into the management-employee relationship. It creates the same strong spirit of unity and cooperation. The head takes the similar sense of responsibility more in terms of social ethics. If a head of a company takes a legally acceptable but ethically unacceptable action, he will be socially accused and will find it very difficult to associate with others in a respectable manner. For no socially or ethically acceptable reason, the head cannot discharge or lay off his workers who have committed themselves to the company and to the leadership of the head of the company. The head cannot sever his tie with those employees who selected the company to have lifetime bondage of dedication, loyalty, pride and honor. It is strongly the responsibility of management to steer the course of the business as if one is planning the growth and happiness of the honorable family and its members.

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*Japanese Society by Chie Nakane (Berkeley: University of California Press, 1970)

This kind of human relationship in the family goes into our company life in Japan. In this context, we are working not simply for money alone, but for the similar kind of relationship we have in our family life. It is almost uncomfortable and even insecure for us not to have this kind of relationship. We do not want to destroy it. We live in the society where you can expect those responses that we have had for centuries and we depend on this. We have lived for two thousand years on the islands of Japan and have developed one of the most homogeneous cultures in the world.

We can depend on the rule that a person once hired and promised dedication to the company, the person will not be laid off or discharged. You can plan the future of your family. You respond to the company, as one would to the head of the family.

2. Life with the Company in Japan

Life with the company in Japan is like an extension of your family life. There you will have another community of similar relationships with the members of the company and the company itself. The top management acts like your father and your senior members of the company behave like your big brothers or sisters. You regard your younger workers like your younger members of the family. They expect you to act as such; and if you do not, you will be considered as a little bit strange in character and might even become a source of trouble to the group. They may not ask you to join them for a drink. It is a bad sign.

In the hierarchical society of vertical relationship, all employees fall into each spot and the organization moves smoothly. The top management takes a great responsibility for the long and happy growth of the company and of the entire members of the company.

Of course, inasmuch as the relationship within the company is close and tight like in the family, the examination for getting jobs is very stringent and thorough. Some times even high school grades are submitted for examining academic performance and ability. Then you may have to pass the company's own written exam. Often they even hold group discussions among applicants to find out natures and leadership qualities of future employees. Congeniality and the ability to harmonize within a group of people are important qualities as well as a bright mind.

It is a common practice in Japan to ask your boss to act as an official go-between when you have found someone you would like to marry. There are many in my company who have married fellow workers. Most of them had their bosses honor the wedding by acting as their official go-between. Some of the important and time-taking duties for senior executives are to attend wedding ceremonies, funeral ceremonies and other social activities of the members of the company. Company life and personal life become closely related. Wives at home are very familiar with and have strong interest in the company business. Through the spirit of caring for your employees, managers and executives are always mindful of their subordinates' families. It is like the relationship of brothers and sisters and that of uncles and aunts and nephews and nieces.

In Japan we have what we call family allowances. When you are married, there will be some allowance for it. The same goes when you have a child. The idea is that the company cares about your family members. It is a moral obligation of the employer--the one who took you in as a lifetime member of the organization. For those who commute from far away, the company provides a transportation allowance. Often the company purchases commuter passes for employees. Housing allowance is also valuable since housing is so expensive in Japan. In practice, it becomes very important for leading companies and those companies who want to attract good quality employees to have good programs including salary scales and various allowances.

This cultural heritage surely helps productivity through dedication and loyalty rendered expectedly in exchange for geniune concern and care by the responsible head. There are always best efforts humanly possible with whatever given material and tools to work with. What we need is not work to fill hours, but work with true and continuing interest in the work itself to gain the best possible result in quality and in efficiency. We need two qualities here. One must by nature find joy in good results and delight in the benefit the organization draws from such good results. It is most critical if the worker is apathetic about the outcome. This cannot happen in our closely knit vertical human relationships.

It would be a mistake if anyone thinks that this type of relationship cannot be developed in the U.S. where society is freer and people value frank and straightforward relationships because we find such a genuinely interested vertical relationship at many successful U.S. companies. Sony is very glad to say that we seem to be among them. Thomas J. Watson, Jr. of IBM said,

> "Along with wages and job security, we have always thought it equally important that the company respect the dignity of its employees. People, as I have said, occupy more IBM management time than our products."*

In the recently published book called, The Art of Japanese Management by Richard Tanner Pascale and Anthony G. Athos** prove this point very well.

I firmly believe all these successful relationships are prompted by the initiative of the top management. In Japan, the top management equally practices this as a natural part of our culture. In the U.S., certain very humanistic leaders of business, almost breaking the ordinary management practice of "hire-and-layoff", insist upon their convinction in the humanistic management approach. The result is so evident in the high morale of their employees. I see no need for the idea of transferring Japanese management style to the United States. The U.S. has its own management style with human values developed by leaders of business who believe in such values. This management style with strong interest in human values seems to be consistent with the Western culture developed by its religions. To be thankful, to love one another, to serve others, to give, to wish happiness for others, and to be kind to others seem to me ways of Western religions. This is the complete opposite of adversarial attitude. Where those human values bond the management and the employees, you have similar and geniune cooperation in spirit ready for efforts for successful productiivty growth or innovation. Based upon religious traditions in the U.S., the human factor is very strong and deep-rooted; while in Japan, our human factor in management comes from not so much Buddist or Shinto teachings, but rather from principles and values developed over centuries through our family life. These principles and values were developed as necessities to keep the family in order and fit for survival. We have been taught to respect elders, to honor and not to disgrace your family, school, company or country, to be thankful for whatever you have, to consider dedication and sacrifice great moral value and to think least of the wordly desire for money and material luxury. But all these values are absolute rather than religious based as in the Western world.

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*A Business and its Beliefs The ideas that helped build IBM by Thomas J. Watson, Jr., (Mc-Graw-Hill Book Company, Inc., 1963)

**The Art of Japanese Management by Richard Tanner Pascale and Anthony G. Athos, (Simon and Schuster,1981)

We are comparatively speaking emotional about these values to the extent people could commit suicide or "Harakiri" when one mortally disgraces one's family or organization.

Dedication and loyalty are so important. For example, if a master falls to a fatal treachery, his people must take revenge and not to do so is considered disgraceful and shameful, as shown in the famous Forty-Seven Rōnin or 47 Masterless Samurai, who successfully took their master's revenge. This drama has been repeated over and over every year in Japan and continues to bring tears of all Japanese forever.

Japanese and Americans may act the same and, yet, each basis is different. And, even though, controlled and tempered, Japanese may be feeling more emotional than on the surface.

We both have solid basis to be concerned and dedicated for the good results in productivity growth and innovation. If these values are felt strongly enough by both the management and the employees, then care and concern by the management will result in dedication and loyalty by the employees.

3. Competition or Harmony

The Japanese are very much in harmony in vertical relationships. Among the same family, school, or corporation, all unite and give the thorough loyalty and dedication to the organization they belong to, but in the horizontal relationship each compete fiercely. This competition is almost like between two hostile enemies. Horizontal competitions among corporations being so keen that employees are much more concerned about the company than their monetary compensation. Employees want their company to be strong in competition. They concert their efforts in the same direction.

You committed yourself to the company for your lifetime and for the lifetime of your career with the company, your family's happiness depends upon the competitive strength of the company. It then becomes your serious concern that the company attains its strength through better productivity growth, better quality control, better product design, better merchandising, better manufacturing methods, better research and development, better financial management and better marketing strategies. All of these are rightly the concerns of every employee. We know very well what would be the fate of those whose company fails and goes bankrupt. In the middle of your career, you join another company. It is a humuliating experience for all the employees. Therefore, everyone gives his best effort to keep his company strong in competition and give their dedication to the company. The management feels a tremendous amount of moral obligation to lead the company in the right direction. It is their responsibility to meet the dedication of the employees, to make the right policy decisions and plannings in the business so that each memeber of the company may continue their employment with the company. This is a serious social responsibility and moral obligation of the management to the employees. Determination to take the responsibility and to fill the obligation is an important requirement upon the management in Japan.

In the U.S., we see more competition in vertical relationships, i.e., management and employees, the Government and business, teachers and students, or even parents and children in some instances. Of course, we are having more and more similar problems in Japan. The competition sometimes takes the form of adversarial confrontation. When the two have to cooperate to successfully compete against horizontal competitors, they are often suffering from poor productivity growth and even poorer innovative results; meanwhile, losing competitiveness to those who are under able leaders and united in cooperation under very humanistic management policies.

Adversarial relationship must be replaced by the spirit of respect, care, concern, dedication and cooperation. Other material things being equal, such spirit will surely result in greater productivity. I reported many things we do at our U.S. plants to achieve harmony and the spirit of family among all people in my May 1, 1981, Joint Economic Committee testimony. We believe the human factor can make a miracle happen. It might be only our perception. If we respect our human nature, it may be only natural that you have harmony, cooperation and achieve the best results.

4. Innovation

The Japanese have not been uniquely innovative expect that our team efforts have created many innovative improvements on basic new ideas. Considering all the great and unique innovations that have been made by extraordinary independent individuals, I am very skeptical about Japan's ability to come out with completely unique inventions. A rare and unique individual is needed in the area of innovation.

Sony's innovations have come from its inventive management who provides assurance and security for long-range research. For example, the successful Trinitron color television is the result of research done over a period of serveral years that was supported by Sony's top management at the cost of several hundred thousand dollars each year just for the Trinitron research. Stable and long-range assurance is very important in creating an atomsphere for inventiveness.

Presently, innovative progress in high technology is so crucial for the leadership in the industry. It is very crucial because it has a devasting effect since so much of our life and world depends upon high technology in electronics. Particularly when the world's peace depends upon the balance of power between the free nations and the communist nations.

Innovation we need today depends on cooperative team efforts and in that regard vertical adversarial relationship should be replaced by cooperative and harmonious one. I believe greater emphasis upon human factor is imperative. Money cannot buy dedication and loyalty.

5. Conculsion

In conclusion, I would like to say that productivity growth of industries in this country can be improved once the top management decides to show with determination their concern towards the members of the family; namely, employees of the company. The top management should become more sensitive to feel and learn the sentiments of their employees. Further, the top management should be more concerned with the welfare and happiness of their employees.

We may not easily produce the kind of innovations that great inventors of the Western world have made, but group efforts of concerted spirit will push innovative progress forward faster than by teams of adversarial attitude. Many U.S. corporations like IBM, T.I. and others have good human relationships within their companies as well as many Japanese companies. The human factor is, I believe, far less emphasized than it deserves. Sony's emphasis upon the human factor in our U.S. plants has proven to be very successful and we are very satisfied with the American worker.

I agree that we need faster depreciation, tax credit, cheaper funds, modernized and numerically controlled machines, but none of these help if people have low morale or poor dedication. Money cannot buy it; it must be earned. Therefore, I urge that we pay much more attention to the human factor for greater productivity growth and innovations.

Thank you.

Mr. **Lundine**. Thank you very much.

I am very interested in your statement at the bottom of page 14 and your emphasis on the fact that the human factor in U.S. plants has been very successful, and that you are very satisfied with the American worker.

Have you used management techniques and approaches here in this country that are similar to those in Japan, or have you varied them because of the cultural differences of the worker?

Mr. **Wada**. It seems to be mixed. May I quickly itemize what we do.

We take particular efforts to honor those who have a perfect attendance. With the perfect attendance of 3 months his name will be listed on the monthly publication. His picture will be shown. So whoever has a perfect attendance gets a pat on the shoulder and people build up value for perfect attendance.

Two, we have a telephone like a "hot line"—you have questions, you have complaints, you don't have to sit down and write something on a piece of paper. You take the telephone, dial 600 in San Diego and 300 in Dothan, Ala.

Speaking of San Diego we have about 1,800 people and about 1,500 people in Dothan, Ala. Japanese are less than 3 percent—run by American managerials.

You have questions or complaints, you pick up the telephone, dial 300 or 600 and leave your question and you get the answer. The idea is we are anxious to hear whether they have questions, complaints, and try to meet it.

We emphasize upon managers to remember first names of workers. It is a different custom from Japan. In Japan we never use a first name, except my parents would call me. So for Japanese making friends with American friends is very difficult. They have to break down their habit or barrier built by habit over resistance to call someone by first name. It is very difficult.

So when we see an American student calling a professor by John or Henry we think that's very disrespectful.

I mentioned the vertical relationship. We are—very closely live with this vertical relationship, so if someone is superior we have a proper expression, all those who are younger and subordinate another expression, just to say "I."

To Congresman Dymally or you I have to use a different kind of Japanese word for just to say "I." You have only one "I."

Mr. **Lundine**. Chris, can I call you Vice President Wada?

Mr. Wada. No, no, please. I have been in this country too long. It's an insult.

So it's very awkward for Japanese people to call American friends by first name, but we believe, like I mentioned trust, et cetera. And we should remember and emphasize—and Mr. Morimoto who heads the San Diego operation—I think, to my memory, this is 600 or 700 people by their first names. But I think that shows concern to the people, not IBM number or a plain number.

Another one. We emphasize management people to eat together in the same cafeteria, and we make it—there is no other way. There is only one cafeteria where they have to eat all together. I eat here, maybe in Detroit. Some people go to specially beautiful cafeteria, and other people go to lesser beautiful cafeteria. We don't believe in that.

Education. We emphasize educating people because direct workers, workers on the assembly line, they can be technicians. You don't have to wait for people with white collar to come in with a beautiful room and the worker around to see what's wrong. No. You have educated the direct workers and they can spot the problems. They are not going to say: "My job is this. This problem is not my problem. This is my problem. This is my problem." Because educated, they know how the whole thing works together—that's education.

No. 6. We have a monthly meeting. At the monthly meeting we tell them Sony has now new joint venture with the Prudential Life Insurance Co. We have a new joint venture with Wilson Sporting Goods. We have—et cetera, et cetera. Because we want our employees to be proud of their company; the company is dedicated for better United States-Japan relationship. This has nothing to do for whatever the work she or he may be doing. But this has so much in terms of the spiritual relationship—to be proud of their company. They could rear a family.

Next. Round meeting. We have a round meeting in Dothan, Ala. Twenty people selected at random—not managerial—sit together with the top guy; he's an American. He came from one of the large, great American manufacturing companies, and he sits with 20 people, and they have no supervisors and no managers sitting in, and they can ask any question. And you're the top guy, you get the question. You are hit by the question. You have no way to escape. You can't say, telling your secretary, "Tell them I'm not in the office."

Mr. Lundine. You don't think we do that, Chris, do you?

Mr. Wada. You don't do that, I know. Always I had a chance to see you, right?

Parties and the celebrations. I think that Peter Drucker said that people do not have to be rewarded by money.

Recognition. First, a definition of responsibility and when something good is done you must recognize them. We do so by calling in disco vans, holding these parties—boyfriend and girl, and we have a real party a few times a year in San Diego, and same way at Dothan. Because whatever good things—not necessarily has to be reflected in monetary reward. We all share good results.

At one time San Diego Assembly Line No. 2—for 200 days has no defect. Every single thing they turn out pass. This is breaking the record held in Japan. So they did better than any color television plant in the world, as far as Sony is concerned. So we had a big party—disco vans, dance, boys and girls.

Mr. **Lundine**. It never occurred to me that in this inquiry about social innovations we'd actually end up on disco vans.

Mr. **Wada**. I really had stated——

Mr. **Lundine**. I understand your point.

Mr. **Wada**. Because this is very bad. Distinguished names here—technology and science——

Mr. **Lundine**. We don't take ourselves too seriously.

Mr. **Wada**. I say this. People are like searchlights, harbor lights—try to see what's over there. What is it across the Pacific Ocean, on the other side of the Pacific? But everything is out in front of the lighthouse—Dr. Deming come from America. Management assistant came from Japan—from the United States.

Twenty years ago when I came to the United States in 1960, on March 16, was working for AID, Department of State, assigned me as an interpreter for teams after teams of, from Japan, to study managing and productivity. So I spent over a year trying to help Japanese management to learn productivity from the United States.

So what I am saying is the lighthouse tried to find something over there, but everything is here—don't have to transfer anything.

Now, next we had a 20th anniversary last year. Chairman Morita and his wife flew in, we had a celebration in San Diego, and in Dothan, Ala., and so forth, and what I noticed—we had three parties in San Diego and Dothan, Ala.—I think was something like 11 o'clock, 7 p.m. and 3 a.m. And we said, "Mr. Morita, you've done enough. Please rest at the hotel."

He said, "Did I come for you? I came for those people who work." And three times—I just hate to be so comical, but this party, this celebration was done Hawaiian style—so we had Hawaiian music, Hawaiian luau, Hawaiian flowers. Well, 11 o'clock people are happy, 7 p.m. still people are happy, but Mr. Morita, Mrs. Morita, 3 a.m.—for the third time—the same Hawaiian music, the same luau, the same Hawaiian flowers, but I was amazed because he's now 60. He with a big smile, group after group. This is because he has hot, warm blood. I think hot, warm blood is very important. That's how you get the people vibrating. [Laughter.]

Well, I think it's true.

No layoff is also very important. At Sony in San Diego we have not laid off any single person. No layoff; it's not easy, because when business is slow you want to lay off people. But you cannot lay off—you cannot say, "Son, I don't need you. Please go away. You're no longer my family." And next month, "I need you; come back and join my family." Once you're a member of family you stick together.

So what do you do when there's a greater opportunity, we wan't to capitalize, but we don't increase employees too fast. Because we don't want to cut back. Steady, fast, we make progress. That's a part of responsibility on the part of management.

Sometimes somebody hired for $2 million—he want to show the company or board of directors or stockholders tremendous growth in sales, and he gets compensated. And after 3 years he will be gone. The company had a big problem—layoff 500 people. That we don't want.

Next, we emphasize the pride with our employees. We try to identify our company with quality products so that employees have the pride in the quality product. You can have the pride in many other things.

Let's see. I talked about the family. Quality control, that came from Deming.

Something interesting, not mentioned in my testimony, but I was speaking with Lou Harris, and Lou Harris made a survey. He didn't make a study but a rather interesting survey, which said: Employees believe more information and more respect will help increase productivity, while the management did not consider information and respect as highly as employees did. Management placed a greater emphasis on equipment, rather than respect and information to employees.

As I observed the situation—and this response to the question, you, sir, posed—what management will do. Management will build more robots, management will integrate complex machine, so that complex machine will be so simple you don't need hands integration. And management will use more of can't than can. Computer aid design, computer aid in manufacturing. You don't need the people. Numerical control. That will mean less labor, at least that's what I see—more robots, more integration, more can't, more can—and what do we need for that—capital.

So that's why capital, capital, capital. But I think you give best weapons, best aircraft, best guns, your soldiers who won't retreat—all these will rust in the desert.

So I still believe given the same capital, I was thinking that more dedicated and more concerned people you have in management and labor you will have the greater productive growth and greater innovative approach.

Mr. LUNDINE. I was most interested in your comments about job security, particularly because you're in a very competitive business. While you've been very successful it has to have cyclical nature to it.

Mr. WADA. Right.

Mr. LUNDINE. But you have been able to maintain your policy of continued employment here in the U.S. operations—even without any assistance from Government or outside assistance in doing so.

Mr. WADA. The Japanese Government made it very difficult for Sony. This goes back to 1953. We went to Western Electric and asked for license on the semiconductor technology, and Western Electric said, "Mr. Sony, this is good only for a hearing aid. You can't make transistor radio." So we said, "We'll try."

Then Western Electric said to please send them an initial installment for licensing fee. The Japanese Government said, "Mr. Sony, we don't want to spend the money for you."

It took almost a year to convince the Government to send the money. So the Government has not always been so helpful, but I think the key of success of Sony come from top management being technical-engineering oriented.

Mr. Morita himself is an engineer—he was a naval engineer. He was tinker-toying a heat-sensitive torpedo. Thank God, before success war came to the end. So heat-sensitive torpedo never succeeded and never used to hit the American war vessels.

Our president, Mr. Iwama, is a physicist. He studied earthquakes. Our founder, Mr. Ibuka is a scientist. The profit and loss balance sheet comes after their satisfaction of ego as engineer.

Ego of engineer is to perfect greater parts. Not so much about money. Fortunately, you have good products, and you don't—well, you have to worry about the money, but the money come along.

And also like our nation, horizontal competition is very keen. And responsibility is very heavy. If my company goes down and if I have to seek a job with, say, Machusta [phonetic] I will be a second citizen forever.

Someone who selected and joined the company right from college at the beginning has a much higher priority. So we stick together, we work together, for our own mutual interest.

Therefore, competition means something you may not realize. It's a keen thing upon us, so we research, we come out with new products, and those who have not been able to survive, many, many companies have gone down. If you save them by Government money or tax money, people become softer—become soft; not strong.

Mr. DYMALLY. Mr. Chairman, just one——

Mr. WADA. Yes, sir.

Mr. DYMALLY. Chris, is Sony participating in the CWETA program in California?

Mr. WADA. No; I don't think so. In 1972 we came to San Diego. Governor Reagan was there, and Weinberger was director of finance, I think, and Bill French Smith was out there advising, and we never got into this discussion in 1971-1972.

Mr. LUNDINE. I thank you very much. You have given us a combination of philosophical—go ahead.

Mr. DYMALLY. Chris——

Mr. WADA. Yes, Mr. Chairman.

Mr. DYMALLY [continuing]. In California we have a very unique and what I consider a very regressive tax called the unitary tax. The unitary tax taxes company profits on the basis of their international incomes, not just the California income. Sony came to California without recognizing that. When I went to Japan in 1976 I met the Sony people and they told me about the unitary tax, I came back and convinced the Governor to go to Japan. He then discovered the intensity of the dislike of the unitary tax. And my assemblywoman, a friend of Mr. Wada, Assemblywoman Hughes, is carrying legislation now to limit the unitary tax.

But the problem we have is there are two parts to the tax: The foreign company section and the domestic company section. The domestic companies, some of whom are oil companies, want elimination of the unitary tax, and the administration in California is not disposed to eliminating the domestic section because the oil companies are making so much money. We have Occidental, Union, Chevron, et cetera. I talked with Mrs. Hughes just recently, and she told me she has reason to believe that the bill would pass.

It passed last year but died in conference committee because of this conflict in the foreign and domestic companies. She thinks it will probably go through with two parts made into two separate bills.

And so we've been working together for some time, and I am quite pleased to see Mr. Wada here today.

Mr. **LUNDINE**. We wish you well in all of those endeavors, and we thank you very much. You've combined philosophical approach with commonsense and good humor and we deeply appreciate that.

These hearings of 6 days are now concluded. I think that they've been very helpful in opening up new dimensions to the productivity problem, which is at the heart of the United States' economic dilemma.

Every single witness testified that human factors are the most important aspect affecting productivity performance. Using different terms but similar concepts and methods, several of the witnesses—both from this country and abroad—suggested that we must have greater worker participation in how their job is organized and carried out.

These hearings clearly demonstrated that there must be better communication between labor, business, and government regarding national policy, and at the workplace.

It's also clear that we must involve workers in the introduction of new technology—both in the factory and at the office. More research should be done in this area of human resource development, particularly where new technology affects the workplace. It's important to me that this research be action-oriented.

And, finally, this subcommittee will present a series of policy recommendations for the consideration of the Science and Technology Committee as well as other committees and the Congress itself.

I wish to thank the staff—of both majority and minority—for their time. I wish to thank the witnesses who have at some times at some inconvenience, made themselves available, and most of all I'd like to express my thanks to Chairman Doug Walgren who I think has devoted an extraordinary amount of this subcommittee's time to the question of human factors in innovation and productivity.

Hopefully these hearings can be the start rather than the culmination of an effort to try to address some of the challenging and interesting opportunities that have been presented.

We now stand adjourned.

[Whereupon, at 11:35 a.m., the subcommittee was adjourned.]

APPENDIX I

SEMINAR ON INNOVATION AND PRODUCTIVITY: A HUMAN PERSPECTIVE

TUESDAY, JULY 28, 1981.

The Seminar commenced at 12:35 p.m. in room B-369 of the Rayburn House Office Building; Ken Prewitt, Moderator.

Mr. **BROMLEY**. I want to begin by thanking all of you for taking time in what I know are enormously busy schedules to be with us today. I am Allan Bromley, President of the American Association for the Advancement of Science.

As I think most of you know, increasingly over the years AAAS has taken an active stance in bringing together national policymakers and outstanding researchers from the nation's universities. Just last month, for example, more than 400 people have attended our Sixth Annual R&D Policy Colloquium. In that one and a half day meeting together with leaders from the Administration, Congress, industry, and universities, we took a look at R&D in the new national agenda.

Today our scope is more modest, our time more limited, and yet we come to you with a very important issue. In planning this luncheon seminar together with the Council of Social Science Associations, we chose a topic which has been very much on the minds of many of you in the Congress—Innovation and Productivity: A Human Perspective.

The main purpose of our seminar today is to acquaint key members of the Congress and their staff with some very important research findings by three distinguished individuals who will shortly be introduced to you.

We at AAAS are completely convinced that good policy is based on good research. And because there are so many dimensions to innovation and productivity questions, sorting out the public policy issues is no easy task for you. But we would urge—and in particular this will be a theme in this seminar today—that you consider very seriously the human resource issue in parallel with tax policy, technological investment and other questions as you consider innovation and productivity.

Let me now introduce Chairman Don Fuqua of the House Committee on Science and Technology.

Congressman Fuqua?

Mr. **FUQUA**. Thank you very much, Dr. Bromley. It is a pleasure to be here today and to see so many people whose faces and reputations are familiar.

As one of the sponsors of this seminar on Innovation and Productivity: A Human Perspective, we would like to welcome all of you here today to the Capitol.

The poet, Pope, said that the "Proper study of mankind is man," and we are here today to do what's proper.

Doug Walgren and Les AuCoin, two of my colleagues, are joining me in cosponsoring this seminar. Mr. Walgren's subcommittee on Science, Research and Technology, and Mr. AuCoin's Task Force on Industrial Innovation, have both been very active in the area of innovation and productivity. I am very delighted to be able to join with them here today.

I also recognize several other members of Congress in the audience, and I would like to recognize them at this time.

Back over in the corner, John LaFalce. John, we are happy to have you.

George Brown from California.

Stan Lundine from New York.

Bob Shamansky from Ohio.

Jim Scheuer from New York.

Others may come and go as the meeting continues. We have, as my colleagues are well aware, a series of votes coming up shortly related to all the recent conferences on reconciliation and all of the other matters that we have before us, and I, unfortunately, we will have to leave very shortly.

But, let me extend my personal thanks to Allan Bromley and the AAAS for arranging this luncheon and seminar, and thank our speakers. I am looking forward to the report of the meeting, and wish that it would be possible that I could join you for a longer time. Standing in the doorway is one of the men I have been talking about, Doug Walgren. Doug, please come on in, have a seat and join us.

Thank you very much for being here today. [Applause]

Mr. Bromley. Let me then turn the chair over to Ken Prewitt, who is President of the Social Science Research Council, and who will act as moderator for the remainder of the program today. Ken?

Mr. Prewitt. The occasion is obviously somewhat timely. Needless to say the members of the panel and many other social scientists and behavioral scientists around the country have read with great care the Congressional Record on the floor debate of last week; were aware that the House had to balance two rather pressing issues, to bring federal expenditures under some control and to make an investment in the kind of science that might have productivity consequences.

I am reminded of something that a faculty member of mine used to say. When I thought I had a good idea, he would always say, "Well, just give me one more sentence, maybe another paragraph or so on that idea."

Well, I have that feeling today because I've read the Congressional Record, I have particularly taken notice of Congresswoman Heckler's comments about the Japanese application of social science research, comments by other distinguished members of the House about the importance of social science research and so forth, and I have a feeling that they have come today to say, "Give us that next paragraph, give us the real set of findings that will help us deliberate about the productivity issues facing the United States today."

We, obviously, have three very distinguished scholars who are prepared to try to give that next paragraph, and I don't want to spend any time getting in the way of their presentations. So, if I can turn very quickly to introducing them in the order in which they will speak:

Professor Robert Cole, Professor Abernathy and Professor Ouchi. You have in front of you short bio statements, and I think I need not delay the program to read off their vita sheets and the rest of their publications and so forth.

We will ask if the audience is prepared to allow the speakers to move through their prepared commentaries, which will only be ten to twelve minutes apiece, and reserve the question period until you have heard all three presentations, because they together form some package on the issues that are of interest to us.

Professor Cole will speak first. Professor Cole has been engaged in comparative research in Sweden, Japan and the United States. Sociologist from the University of Michigan.

He will address a very difficult issue: what is involved in borrowing ideas from a different culture?

One of the things that we have not done a very good job of in the United States, especially in the social and behavioral sciences, is to create import structures. How do we extract good ideas from other societies, other research traditions? And, with respect to the issue of human resource development and the practices of work organizations, Professor Cole will share with us today his own research findings about the difficulties of translating across cultural boundaries—what we can and cannot learn from Japanese practices.

Thank you.

Mr. Cole. Thank you, Ken.

As an aftermath of World War II, the United States emerged as the undisputed industrial leader of the world. We dominated world trade. Industrial managers, teachers, union officials and government officials in Western Europe and Japan flocked to America to learn the lessons and the secrets of our industrial success.

In such an environment, it was extremely difficult for American managers to think that they had much to learn by going abroad to study foreign practices. And, indeed they still have a great deal of difficulty today. And that may, indeed, also be one of the reasons why we have not developed very well what Ken just called import structures.

Recently, some rather glaring weaknesses have developed in the American economy, and it is now apparent that America no longer dominates the emerging highly competitive global marketplace. Suddenly, throughout the country in management seminars and weekly magazines, we are being told—particularly industrial managers are being told—that we must learn from the Japanese.

The conventional wisdom has it that the Japanese simply apply the ideas of U.S. experts to Japan. And, if you start with that premise, it follows that all we basically need to do is to borrow back from the Japanese what we taught them in the first place.

Or, even more simplistically, we ought only simply to read our own textbooks, because that's what the Japanese ended up borrowing, anyway.

I've spent a fair amount of time in the last couple of years looking at Japan's rise to supremacy in product quality, and that's an oft cited example of this process. And, I want to talk to you a little bit about my research in that area.

It is apparent from that research that the process is a good deal more complicated than suggested by the aforementioned model, and that has some rather important policy implications for those who would learn from Japan.

First and foremost, borrowing from a foreign culture is not a one-to-one relationship, especially in the area of organizational software. And, although Americans like Dr. Juran and Dr. Deming were quite influential in teaching the Japanese various aspects of quality control, a close examination shows the Japanese adapted the ideas of these Westerners to fit their indigenous cultural, political, economic and social environments, and indeed adapted them in ways that the Americans absolutely had not anticipated.

Similarly, although Japanese managers and Japanese academics also borrowed heavily from the American social sciences, they similarly combined that knowledge with indigenous knowledge and practices.

Perhaps the most visible and dramatic example today is the much-heralded quality control circles, which evolved in Japan in the early 1960s, and have now been adopted at least on an experimental basis by over 400 American corporations, by my count. In fact, according to a survey that I'm just in the process of putting together, I estimate that over 150 American corporations have had quality control circles operating for more than one year, which is rather impressive in some respects.

Quality control circles, for those of you who haven't been reading your business magazines, are small groups of employees doing similar or related work who meet regularly to identify, analyze and solve product quality and productivity problems, and in general to improve operations, work operations.

For all the American expertise that went into the formation of the Japanese approach to quality, it is quite clear that there was no American in the early 1960s who was advocating the extension of quality responsibility to teams of production workers. Some American experts like Dr. Juran were advocating making quality a management function. There was Dr. Feigenbaum's concept of total quality control, TQC. But at most these Americans thought in terms of extending quality responsibility to supervisors.

But the Japanese in a rather characteristic postwar fashion took this concept of TQC and followed it to its logical conclusion by extending it to blue collar workers. And, incidentally, that pattern can be seen in many other areas of borrowing by the Japanese. They have taken many American ideas we developed for management and extended them to production workers as well. And they were inclined to do so not because they were inherently smarter than us, but because of some specific historical as well as postwar experiences.

The point to be stressed here is that just as the Japanese took American ideas and adapted them to their indigenous environment, we will have to adapt Japanese practices to our environment. That is so obvious to me, in a sense it is a cliche—if it wasn't for the kind of debate that I hear in industry circles again and again, that reminds me of the need for this to be said.

Much of my own research has been directed towards delineating the nature of this adaptation process. Let me just throw out three issues to illustrate the point:

First, at the most elementary level the term quality control circles doesn't fit, doesn't sit very well, with American workers and unions. So, many U.S. firms are adopting different names, such as quality circles or employee involvement teams and so on.

Now, that's an elementary example, but it illustrates the point very well.

More substantively, Japanese unions were not actively involved with circles, but in the heavily unionized industries in U.S. manufacturing, it is critical to involve the unions if the circles are to win acceptance, because the unions have 500 different ways to sabotage those activities if they choose to.

And, how that is to take place is an important arena for social science research that I, for one, am pursuing. And if I had more time I would lay out some of the particular strategies that seem relevant here.

The third point: there is a facilitating function to be performed in terms of insuring the proper human dynamics in circle meetings, and in running interference for circles, vis ́a vis middle management which is often very hostile to this kind of activity.

In Japan, the existing repertoire and style of supervision lent itself to that kind of participatory activity. So no special facilitating personnel were necessary. But in the U.S. the social skills are not widely diffused among our supervisors. Consequently, some outside assistance and training is necessary.

One of the big issues facing firms adopting circles is what form this assistance should take. And again, I think social science research has a rather important role to play here.

Let me turn now a little more broadly to the issue of what can be really learned from the Japanese. I, personally, believe that quality circles have a rather important contribution to make. But, I also happen to believe that they are being rather overplayed. There is clearly a faddish quality to all of this—it is not the first fad to hit American industry, and surely won't be the last.

A more important lesson is the Japanese approach to human resource development. Japanese employers are fully committed to developing the skills of their employees, to recognizing that all employees have an important contribution to make to organizational performance. Management stresses the perfectability of human nature, if you will; they assume that workers have the capacity to absorb training, the motivation to use it constructively. There is tremendous emphasis on multiskill formation among production workers, for example; and I think they put us to shame in many ways in that regard. We tend to narrow skills as workers grow older, they tend to broaden them.

To put it still a little more differently, Japanese managers view their employees as resources, which if cultivated, will yield economic returns to the firm. In other words, I am not suggesting they are in it simply because they are more humanitarian than American managers, they see a real payoff, and a payoff in which employee loyalties and skills are important assets in the economic struggle for survival.

Let me just say a bit about the auto industry. It's an area I'm doing some work in, and I think it may lead into Bill Abernathy's remarks.

The popular press suggests that the Japanese hold significant advantages in auto technology, in robotics, and advanced technology. But a lot of these reports are plain wrong. It is the consensus of those who have worked in this area that the Japanese have very little technological advantage in the automobile industry. Rather, what is critical is a set of organizational practices and skills that they have developed.

Let me just relate a story to you, since I just came back from Tokyo a couple of weeks ago, and I spent some time at one of the major research "think tanks" in Japan. They were recently commissioned to do a study for the Japanese auto supplies of, "what is the possibility that the U.S. reinvestment in automobile industry revitalization will pose a competitive threat for them in the future." And their tentative conclusion was, "not too much of a problem."

I was a little sad about that. [Laughter.]

And their reasoning went something like this: Productivity increases are pretty much generated by three factors: new technology equipment, about 30 percent; 10 percent machine layout and design; and about 60 percent overall manufacturing system.

Their point was that the Americans are putting all their money into the technological fix, and that's not where a big piece of the action is.

Now we may disagree with their conclusions but I think it's rather reflective of the way they think about these kinds of issues.

One last point, since Ken is going to tap me any second now. I've been studying for some time the diffusion of participatory work practices in Japan, Sweden and the U.S. and I would like to make a couple of observations about that.

In the U.S. and Japan, I've been focusing on the spread of quality circles both within firms and between firms. There are some rather striking differences between the U.S., Japan and Sweden, with the U.S. being the odd man out. Particularly notable, in Sweden and Japan, the relevant interest groups—sometimes industry, sometimes labor, sometimes government, sometimes in combination with one another built nonprofit associations, or facilitating organizations that were designed to evaluate best practice, standardize information and disseminate information among potential users.

In the U.S., however, this diffusion of information tends to be dominated primarily by private consultants. They treat information as proprietary. In the case of quality circles, the number of consultants seem to be growing almost as rapidly as the number of companies adopting circles. Which is to say that in addition to those with good information and training materials, there's an awful lot of charlatans out there. And all you have to do—at least in my case—is answer the telephone every day, because I get phone calls from companies asking in effect what is good information, who is a good person. And they have a tremendous problem, they will tell you, in seperating good information from bad information.

I draw two conclusions from that: First, that there is a need for some nonprofit associations to fill this vacuum, and I've been working in this connection with the American Society for Quality Control and also the International Association of Quality Circles, to try to help upgrade their services in this area.

But secondly, there is also a role for social scientists to help evaluate different experiences, not to show in some pseudo-scientific fashion that circles really work or don't work based on an experimental model. And unfortunately, I'm rather critical of some of the social science research in this regard. Which is to say that I'm not here to tell you social science is all wonderful and social scientists only do wonderful things.

But I would like to see a lot more focus on the consequences of specific strategies. And, lest my message appear a bit opaque, I think federal support for the social sciences is critical in this regard, and I certainly wouldn't have the knowledge and capacity to do what I'm doing, if it hadn't been early in my career that I received support from the National Science Foundation, National Institute of Mental Health, and was a Fulbright Research scholar.

Thank you. [Applause.]

Mr. PREWITT. Thank you, Bob.

We turn very quickly now to Bill Abernathy of the School of Business Administration at Harvard. Many of you will be familiar with the quite critical article he wrote having to do with the structure of incentives, particularly in business, and how they emphasize short-term investments, short-term profits and so forth which impedes strategic long-term planning.

Professor Abernathy has done considerable research on productivity differentials between Japan and the United States, differential successes on R&D policies with special reference to the auto industry, and I think will keep our focus on the Japan-U.S. comparison.

Mr. ABERNATHY. Thanks.

I will speak extemporaneously today but first, I want to say that I am not a Japanese specialist, as my two copanelists are. My interest is in the management of innovation, technology, and production. During the last few years I have spent a lot of time studying the automotive industry, worldwide.

I recently returned from a three-week tour in Japan sponsored by the Harvard Business School where I had intensive discussions and facility tours with the five largest Japanese firms and some suppliers. It was very interesting. I think it is fair to say that I come back with a considerably different viewpoint than I took over. I was originally very skeptical about the benefits from ideas like quality circles and of the advantages that the Japanese might realize from the behavioral side. I came back much more impressed with such Japanese practices, but much less intimidated.

Japanese quality and productivity achievements are very substantial but they are not competitive threats which we would be totally unable to counter. But, there is a lot of work to be done.

Basically, there were no surprises in Japanese technology but, let me come back in a few minutes to the trip and tours and some of the generalizations that seem appropriate.

Before discussing Japanese practice, I would like to focus for a moment on the competitiveness and productivity of United States industry and what has happened in recent years to it. I think most of you are aware of the problem, but let me summarize very briefly. In recent years the rate of productivity improvement in the United States is one of the lowest in the Western world. Certainly, much lower than Japan. In terms of moving averages, we probably are a little above the United Kingdom in respect to productivity increase, but behind Italy. So, we are somewhere in that range of being inadequate.

But that may not seem so bad after all. Productivity—is an abstract concept that we can all complain about without criticizing anyone personally. It has little direct connection with specific competitive actions. But, there are a lot of problem symptoms that do have an obvious connection with reality.

In an exploratory research project last year, one of our graduate students called a good number of firms, consultants, or industry specialists and asked them the following question:

"Do you know of any instances in which the Japanese have made a competitive invasion in your industry and they have subsequently been repelled through competitive counter moves?"

In other words, are there any examples where Japanese firms have made a competitive thrust into a market like cars or video recorders, or transitors, but where the result has been that the assault was repelled.

The answer from this simple study was that maybe there have been a few such cases but very few!

So, in the critical test of competitive vigor, U.S. firms do not measure up so well.

Japanese firms have pretty well been able to take over where they tried. We laughed for a while when the Japanese first brought their little cars into the country. At first they did not run well on freeways and they weren't well styled and everyone laughed.

Few are laughing that much anymore. Neither do we laugh in reference to other product areas where the U.S. was once supreme like transistors, video recorders, TV sets, and many other high technology products. U.S. industry faces a real problem and not just an abstract problem.

There is a host of other evidence ranging from declining rates of innovation in the United States to studies which pinpoint many problems in specific industries. For example, reports by the National Science Board suggests that the rate of innovation has shifted over the last few decades, away from more basic change. Patent data shows that there is also a problem when technological change is measured in this way.

I find the recent difficulties of one particular industry to be instructive, this is the machine and tool industry. I would agree with economic historians when they say that the economic strength of the United States has been built on skills in mass production for mass markets. This in turn rests on the particular genius of U.S. industry in the development of capital goods and manufacturing concepts to support the mass production as with the work of Eli Whitney, Henry Ford, and others. Well, now increasingly innovative machine tools are coming from abroad. This indicates we are no longer pushing forward in those important areas of manufacturing management that produce concepts which can be "capital embodied," i.e. turned into machines for sale! The loss of market share over the last couple of years has been dramatic.

Let me cite two specific examples: productivity and the competitive problems. Professor Cole has already referred to one, the automobile industry. But, let me take his example a little further since this industry is very important as a bellwether of U.S. industrial practice.

I have been involved with the U.S. Department of Transportation and with the National Academy of Engineering in studies relating to productivity and competitive status of the automobile industry.

We have gotten examined in some depth, the productivity differentials between the U.S. and Japanese industry. Whereas, most congressional testimony of a year and a half ago attributed the Japanese landed cost advantage in cars to the difference in labor rates. This arises because U.S. labor rates are roughly $19 an hour, while Japanese labor rates are around $9 an hour. At 100 labor hours per car, this imples a $900 gross differential after netting out transportation and tariffs, the little ones that exist, a $300 or $400 landed cost advantage may be presumed on the part of the Japanese.

This is approximately the number which the Council of Economic Advisors gave to Congress of prior years.

Although fully definitive studies have yet to be released, growing evidence is pointing to a large productivity based cost advantage in addition to the $900 due to labor rates, there is probably an additional $800 to $900 due to productivity differenctial.

What this really means is that whereas we take maybe 100 hours to make a car—man hours—the Japanese take maybe 50.

Now, that's a very startling number. I think the total Japanese advantage is closer to the $1,500-1,700 range for each landed vehicle than even the $1,000 which the Office of Technology Assessment recently claimed.

How can a firm compete with a $1,500 landed cost advantage? It is certainly very difficult. [Laughter.]

That's the problem which Detroit now faces. And I think they are facing up to it more aggressively than many other threatened industries. Let me carry the point a little bit further. The cost difference is now becoming broadly perceived but there is much less agreement on reasons. We still have the press saying, "look at those robots." "There are no workers in Japanese plants."

Well, let me tell you from my own recent visit to Japan; there are workers in the plants and they are darn good ones. The plants are well managed and they are very effective. But in terms of automation, in my judgement, there are U.S. auto plants which are as much or maybe more automated than the famed ZAMA plant.

I have visited U.S. plants in which the level of automation is higher than the ZAMA plant, in my opinion, although the automation didn't take the form of robots! The answer is not to be found in simple difference of technology.

Even where U.S. plants are brand new, in comparison with otherwise equivalent Japanese plants, they suffer from the same low productivity differentials, somewhere approaching to one to two. The problem isn't just the auto industry either. For industries producing other mechanically based products, one will also find productivity levels approaching a two-to-one or three-to-two ratio in comparison with Japanese plants for a panoply of U.S. industries.

With such systematic differences there must be a systematic reason. What is there about the Japanese firms that makes the difference if it isn't automation?

It's my own perception, and one strongly confirmed by my visit to Japan that it has a lot to do with causes that are best explained by what we here refer to as the behavioral sciences. At the Harvard Business School we might also call it good management. [Laughter.]

Management in Japan has forged an allegiance with labor, or with the workforce, as it were, that has turned out to be very constructive. They have found a way to capture the imagination of workers, instead of just employing just the arms and legs of labor, they turn the spirit of the workforce to the competitive purposes of the firm.

I had the pleasure of sitting in on small group activities and a quality circle meeting in Japan to see how they work. I went over feelings that such small group activities had more form than substance and might represent a little bit of hucksterism. [Laughter.]

But, I came back believing that there is a great deal of substance on the way that Japanese managers and workers relate to one another. That is only part of the mosaic of Japanese management. Of course small group practice is only a part of Japanese management methods, but they are an important part of the overall mosaic that has made Japanese firms so successful.

On the other hand, I have developed the distinct impression that such management practice is not black magic. U.S. firms do not find themselves in a hopeless situation. They can compete. To catch up we must learn something from Japan for a change. The necessary changes may require some institutional change, however, particularly so far as management's relationship with labor is concerned. But I think we can compete if the challenge is accepted.

These productivity and workforce issues are only one half the problem. The competitive problem which U.S. firms face may be partitioned into two dimensions—one deals with management of manufacturing, as I have discussed. Here, the Japanese are masters. We haven't worried much about management of manufacturing since Frederick Taylor in the 1920s, much attention has been focused upon issues of finance, marketing, regulation, and government policy, but not much in regard to quality, productivity, workforce or other subjects involved in the management of manufacturing as a competitive weapon.

The second side of the partition where Japanese firms are ahead is in incremental or product perfecting innovation. Not that they are better at epochal innovation—in fact, many would argue that they are probably not as skilled as we are at making use of science to development radical new products. The simple facts seem to be that their management incentives encourage more farsighted behavior in advancing existing product fields.

Take the consumer electronics industry for example, where we were dominant in the 1950's. U.S. firms not only dominated markets but also technology. While German firms may have originated magnetic recording, U.S. firms invented the transistor, the video recorder, and perfected television steadily but surely—however—the Japanese have come to dominate all these fields. They developed the first commercially successful pocket transistor radio. They have taken over the television industry, and they have developed the first video home tape recorder. Most new products in the consumer electronics industry are dominated by firms in the far east.

Why?

My time is short, but I would like to suggest a reason by way of example. Some twenty years ago, I was a practicing electronics engineer in a large electronics firm. The signals about consumer electronics were strong, it wasn't a challenging area for investment. It involved routine, mature mass production technology and presented less than a rewarding future for young engineers.

Management had decided it was a mature industry and all the talent was focused on industrial electronics, on components, on computers, military electronics, et cetera. The whole industry segment was left as a vacuum, because management had decided it was mature, and there was nothing more to be done.

What I'm saying is that the innovation problem, the second part of the problem, can be largely laid at the feet of management. It has been management's own rule of thumb and practice, and their lack of long-term incentives that has become a self fulfilling prophecy. An industry will certainly be mature the instant all competitors think it is mature. The Japanese have now brought us some fresh thinking.

My own view is that anything the Congress can do to encourage long term investment by firms or to encourage the internal development of technology rather than the acquisition of technology by firms, would probably boost our capability over the long run.

There is a tendency on the part of American management to act like capital brokers. Everything can be bought or sold. New product development can be bought through merger or outright purchase of small companies, innovative machine tools are to be purchased, not developed, and neither does labor require developmental investment rather, just buy and discharge decisions, and you just buy them. Everything has a market. Everything has a value. Everything has a price.

This is a much different attitude than you will find in Japan, and Germany. Over there, the attitude is more developmental. You may invest in workforce capabilities but the workforce is not a commodity to be bought and sold. As a nation, we need a new set of incentives in our major institutions. Management and labor need to seek their long term advantage from pulling together for their joint benefit and that of the country. Incentives to encourage a longer term developmental perspective are needed for senior and middle managers of our firms. The transiency and excess mobility that has been fostered within our workforce at all levels grows out of a view which treats people as commodities. A more developmental approach to people as well as technology would be a step in the right direction.

Thank you. [Applause.]

Mr. Bromley. If I can interrupt for just a moment, I want to recognize Congressman Seiberling, who has just joined us.

Mr. Prewitt. I can't resist saying that I was recently in Japan. [Laughter.]

Not actually to investigate productivity at all, let alone the auto industry, but talking to social scientists in Japan, I add a footnote to what Professor Abernathy just said: We invented—the United States invented, for example, survey research as a tool of governance; we invented demographic projections as an aid to local planning; and I was shocked at the degree to which those intellectual inventions, have been absorbed into the Japanese governance process, or for planning process and so forth, and taking them much further than we have been taking them ourselves.

So, it is not just in the hardware that they are taking our inventions, but very much so in some of our intellectual products as well.

Mr. Prewitt. Professor Ouchi, also a professor in management, School of Management, UCLA, will be known at least by name to many of you because of the wide attention that has been given to his book, Theory Z. He has been investigating more recently the electronics industry in the United States and Japan, a study of about 800 different electronics firms, is particularly interested today in sharing with you his ideas about how incentive structures which are faced by firms, inhibit forms of cooperation—whether they are cooperation within firms, the sort of thing Professor Abernathy has been talking about, cooperation between firms, or indeed even cooperation between the government and American industry.

So, he will be talking to us about incentive structures primarily based upon his recent research on electronics firms.

Mr. Ouchi. I think this podium was built for a congressman from Texas, so I will stand in front of it, rather than behind it.

[Laughter.]

As I came in this morning, I saw Bill Vaughan just left from the staff of the Subcommittee on Trade, Ways and Means, and he told me that—I don't know if you all heard this, there was a late news report from—I've forgotten where—someplace in the Middle East. Apparently, three foreign managers were sentenced to death by a firing squad for alleged acts of espionage. They were, apparently, a Frenchman, a Japanese and an American.

Before they carried out the execution, they asked the Frenchman if he had one last request. He said, yes, I'd like to sing the Marseillaise one last time.

Then they asked the Japanese if he had a final request, and he said, I'd like to give one last lecture on quality control circles.

And then they asked the American, and he said, yes, please shoot me before the Japanese gives his lecture. [Laughter.]

Well, I wanted to put up a couple of slides on the far wall. [Slide.]

I want to make a couple of comments today about the set of incentives both within the firm and between firms, that I think have everything to do with the characteristics of Japanese industry.

It strikes me, first of all, in studying the Japanese example, our proper objective is not to want to emulate what they have done, because our conditions are so different. But rather to create, if you will, an intellectual island on which we can stand, and from which we can see more clearly what it is we have developed in this country.

Now, one way to summarize the underlying characteristics of the large Japanese firm, is through the seven dimensions.

Lifetime employment, as Bob Cole's work has shown us is a very important practice. It is not universal. There is, indeed, a fair amount of turnover, particularly in the first five years of employment. But, among the major firms there is the attempt and the expectation that young people will be hired right out of school, will stay there for a lifetime, will retire—the average retirement age is about 57.3 years now. Upon retirement, people receive typically a very small pension. They do receive a lump sum separation, which may amount to around five or six years' worth of salary. They are living in a highly inflationary period, they have a life expectancy of nearly 80 years, and they therefore know that they must save in order to meet those needs later on.

In addition, there is the practice in firms of paying all employees from the top to the bottom, about a third of their total income in the form of a bonus which is basically profitsharing paid twice a year in a lump. That bonus is not an individual performance bonus which is commonplace in the U.S. And therefore, it does not lead to individual attempts by one worker or executive to outshine another, which often produces tremendously uncooperative results.

Instead, you have a system in which, during a bad year, a firm can delete the payment of that bonus and effectively cut its payroll by a third without having to lay anyone off. Now, if you are looking at a short-run decline, that means that when the business comes back, you are sitting there with a loyal, trained workforce ready to go. Everyone shares the grief equally during bad times, the shareholders, the managers and the employees.

Typically, in a major firm there is a very slow process of evaluation and promotion. It will not be for ten or fifteen years that the first major distinction will be made between employees, and one will receive a larger promotion and another a smaller one. The very slowness of this evaluation procedure, means that people have strong disincentive to take a short view, because you know you won't be evaluated until the long run, and you know that anyone you might have done something to meanwhile will still be there because they are lifetime employment. [Laughter.]

The career paths, again as Bob's work has shown clearly, tend to be quite different—not in every instance. But by and large there is an attempt to have people move very broadly from one task to another, which has the effect that you have people who are well informed about the other stages in the service or manufacturing process, and understand one another's language, know the people, know the problems. And therefore, are capable of working together. And in addition, because they know that they are going to continue to move around the company throughout their career, you always have an incentive to be cooperative. Because that other person over there who is a pain in the neck today, is someone who is almost certain to be your close coworker at some point in the future.

All of this makes it possible to pursue a very consensual process towards making decisions.

Now there is a large class of decisions that is still made by the boss working on his own. But there is another large class of decisions, in particular those in which the implementation process is critical, in which everyone who will be involved in the implementation is also involved in the making of the decision, even though that may mean 60 to 80 people.

Now that process leads to some very important results when you have a complex new problem. For example, the fundamental changing of an industry in 1959 as you may know, about 80 percent of the U.S. motorcycle market was held by Harley Davidson, BSA, BMW, Norton, Villiers, Triumph and Vespa. A short ten years later, in 1969, 90 percent of the U.S. motorcycle market was held by Honda, Kawasaki, Suzuki and Yamaha.

That had a lot to do with the fact that this was a period during which there were many modifications in the design and manufacture of the motorcycle engine and frame. And it took the Western firms about 34 months to go through a new product cycle, while it took the Japanese about 17 months. And that meant that the Japanese were always on the market with a product with features that people wanted at a lower price, and the Westerners simply never caught up.

That had everything to do with the fact that in the Japanese companies, people were able to work together, all of the several departments coordinating their activities, because they were singing off the same songsheet. Whereas in the U.S., one engineering group would do its job, and before it passed off the task to the next step, there would ensue a long period of negotiation and contracting and signing off in order to firmly fix responsibility, so if a motorcycle ended up with three wheels instead of two, everyone knew where to point.

There is a strong sense of collective responsibility that I think—in every nation, of course, the underlying tension is going to be one between individualism and collectivism. There are a whole host of structures in Japanese society as well as in firms, that give people an inducement to take a strongly collective view of responsibility.

That is emphasized in the quality control circles, it is emphasized in many ways in Japanese life, some of which I think we would not be able to replicate in this country.

One of the more interesting aspects to me of the Japanese firm is that the fundamental progress of management works through a philosophy. On the one hand there appears to be a very formal, exquisite, highly ritualized form of interaction in which subordinates rarely disagree with superiors at work. But, if you look just below that surface, what you see is another system, one in which there is an underlying philosophy that people have discussed over many years, that guides their efforts and allows them to understand with a good deal of subtlety what the underlying nature of the business is to be, and how it is to be conducted.

Finally, you all know that Japanese firms are characterized by an extensive array of softball games and golfing outings and drinks after work and dinner and the whole thing. I think that the fundamental reason for those activities is that, what I would refer to as a very wholistic, as opposed to a very limited and segmented relationship is the following:

It is very easy because industrial life by its nature is necessarily hierarchical, it is very easy for that hierarchy to develop into the kind of authoritarian relation in which those at the bottom of the organization understand that in fact they have nothing to say about the conduct of the enterprise, and at that point lose all interest and all hope of cooperation and productivity is lost.

Now, if you restrict your interactions with employees to that narrow range of activities that takes place in the office or the plant, then you, the boss, can sustain the fiction that you are in every way the superior, because you are in that artificially narrow range.

But, if you play soccer or softball with those people, that you drink or dine with them, then you inevitably create some settings in which those who are superior at work, become if only for a moment, subordinate, because you cannot hit the ball as far, run as fast, sing as beautifully, drink as much.

And the point is that you cannot signal that underlying acceptance of an egalitarian ideal as clearly at the office as you can away from it. And that, I believe, is an important reason for that wholistic range of activities.

Well, very briefly, if we look at the typical Western firm, what we find is that it is fundamentally the opposite in every respect. There is a set of characteristics here which evolved, as Alfred Chandler's work shows over the past 150 years. His History of the Development of Modern Industry in America shows the form of organization that we have developed in the U.S. is fundamentally one that was accustomed to an industry of 150 years ago, in which each worker was an individual crafts person, who understood their trade, and the job of management was simply that of taking the set of individual craftsmen, each of whom knew their trade, and linking them together in only a loosely coupled fashion.

But now, the progress of industrialization in America is led always toward more and more integration of several distinct subspecialties, and the need to meld them together into an integrated team. The characteristics of this form of organization are not well suited to that kind of industrial setting. [Slide.]

Now let me just observe, because I am about out of time, one last issue. At about the time of World War II, you probably know that the major firms in Japan were organized into a small number of groups called Zaibatsu—here the fictitious Mitsubeni group.

Each consisted of about 15 to 20 major firms clustered around a commercial bank. In turn, each of the major firms had clustered around it a host of satellite firms which were typically their vendors.

Now the American Occupation Forces broke up these groups legally so that each today is a separate freestanding corporation with its own shareholders, directors, so on and so forth.

But the Occupation Forces were not terribly good on their implementation as it turned out, and shortly after they departed Japan, the groups reformed themselves around these banks. Now, in Japan as in West Germany, you will typically find—this is particularly striking in the electronics industry—what we have found in reviewing the 700 publicly owned electronics companies in the U.S. is that they are overwhelmingly owned by individuals. In Japan the large electronics firms are overwhelmingly owned by institutions.

And particularly you will find that the group of banks will own typically 23 to 25 percent of the shares, equity shares, of each of the major firms in the group. And then the other member firms in the group will hold shares in each other, with the result that more than half of the shares will be held within the group.

In addition, the bank is permitted to provide both short- and long-term financing, as well as holding an equity position.

Now what that means is that when you have a new business with an unknown technology, for examle in semiconductors, a U.S. semiconductor maker will go to its banker and say, "We need $50 million for a new fabrication plant."

And the banker will say, "Well, that's a risky loan, so we'll give you $20 million."

And the consequence is that that house will grow at 40 percent the rate it should.

In this setting, what you have is a set of people who have an intimate relationship with one another, who know that no one is going to pull a fast one, who know that they are not going to walk away from one another, and the consequences are that if that guy really needs $50 million, he is likely to get it, and will grow at the rate that he needs to grow.

It also means that when new technologies develop, they are allowed to flower in a semi-independent state, rather than having to combat an old technology under the wing of a massive company.

But on the other hand, that old company is able to have a close relationship with the small company involved in the new technology, because once again the two sides know they can trust each other.

One consequence is that each company, for example, the computer manufacturer and its semiconductor supplier, will form quality control circles which will meet jointly, regularly, to exchange information at very basic levels. It also means that they will willingly exchange planning information of all sorts with one another.

Well, it seems to me that as we think about the form that American industry is going to have to take over the next two or three decades, we need to have some understanding of what the underlying nature of the structure of American industry is. I think the electronics industry is a good example. We do not have a good idea, we do not know the answers to the questions, indeed, what is the impact of our current capital market structure in the U.S.?

The New York bankers will, by and large, argue that a deposit bank should be kept separate from an investment bank. Glass-

Steagall, in its original conception, was correct. That you have in fact a conflict of interest if one bank is permitted to hold both equity and debt in the same firm.

There are some alternative ways to reach the same protections without fouling up the movement of capital into those industries that are most rapidly growing. We don't know.

We don't know how we can best manage the critical relationships between suppliers and equipment manufacturers in the new technology areas. And those are the kinds of questions that I am attempting to look at now, working with the support of the Office of Naval Research.

I thank you for the opportunity to be here. [Applause.]

Mr. PREWITT. You, of course, saw a beautiful example of Japanese management cleverness, as Bill slipped out of my control by moving to the front of the podium, so I couldn't monitor his time. [Laughter.]

The floor is open.

Mr. SHAMANSKY. I am a member of the Science and Technology Committee—both in the Subcommittee on Investigation and Oversite, and in Congressman Walgren's Science Research and Technology Subcommittee.

Both those committees have been exploring the question of creativity and innovation. I have reached the reluctant conclusion that the products and processes are available. But unfortunately, Professor Abernathy, the management seems to get out-hustled. Just simply out-hustled.

I'm obviously going to be accused of a bit of parochialism, because I am from the other side of the river. My question to you is: are you satisfied with the performance of the B school and the other business schools in the atrophying of American management?

Mr. ABERNATHY. Never. [Laughter.]

Mr. SHAMANSKY. How did this come about? And did you analyze this?

Mr. ABERNATHY. No. I am not satisfied and it is not atrophy. I think a big change occurred, in the 1970s, a finance fad hit and all of a sudden,—I was at Stamford Graduate School of Business at the time, but all of a sudden three times as many students as before wanted to take finance courses. I don't think that it was anything the school sponsored, or promoted. Essentially, universities run a free market operation; students vote with their feet. So they take the courses they want to take and they pursue those interests they want to. The faddish swing occurred in law.

I think, (that it is true that) we have not provided enough balance in the curriculum in terms of business aspects like production, workforce and other behavioral subjects. We may have offered too much economics, finance, and emphasized financial control too much.

But I do not think schools were not leaders in this trend. In this case schools followed the financial merger wave and the legal wave which began in industry and the courts. I think we universities might well have taken a stronger position in terms of forming management opinion. It is a little like asking the law professor to disclaim the excessive reliance on lawyers in our society.

So in that sense I think we are deficient. I don't think we caused the problem, but I do think we were deficient in not taking a strong enough role.

Mr. PREWITT. Congressman Seiberling.

Mr. SEIBERLING. There are two theories going around and I am not sure they are totally inaccurate, concerning reasons for our falloff in the rate of productivity growth.

One, which I tend to think must have some validity, is based on the fact that this country spends a larger proportion of its GNP on military things than any other of the Western countries. It is also true that a large portion of government-sponsored R&D is spent on military R&D.

The Japanese are at the other end. They spend the least amount of their GNP on military concerns. I assume that applies to R&D also.

There is a correlation between their productivity growth and ours, perhaps because of that fact.

The second thing which I think is probably more of a cliché is that welfare and the welfare state approach in this country have robbed people of work incentives. Unemployment compensation is grouped along with welfare. Therefore, people have no incentive to work hard or to learn more skills, because they can wait a year and get unemployment compensation, or they can go on welfare.

I wonder if the panel would comment on either or both of those theories. We have just talked about techniques so far, but there are macro factors that probably have an effect.

Mr. COLE. Just two quick comments, more on the second than on the first point.

On the first, I think we tend to emphasize the spinoff effects of military R&D in terms of commercial applications. If you think about it, that's a rather inefficient way of producing those outcomes, as opposed to directly gearing your R&D to those outcomes.

But the second area is the one I spent a fair amount of time researching. In my most recent book I did a rather large-scale survey of workers in Detroit and Yokohama, looking at various kinds of work commitment measures. I went in with a lot of these stereotypes myself. And what came out was, very little difference between work attitudes among Detroit and Yokohama workers. Surprise of surprises, in terms of work commitment demonstrated by workers, Detroit workers came out with similar or slightly higher scores.

And the conclusion I drew from that based on other research as well, is that the difference is not work commitment and motivation, per se, but it is on a kind of incentive structures and reward structures in industry that both motivate people to perform, and allow them the opportunity to make constructive constributions to the firm.

But I think there is a lot of hogwash about the decline of the American work ethic, et cetera, et cetera.

Mr. ABERNATHY. Can I add my two cents to that?

I'd like to pick up a theme I mentioned before. I think in this area, U.S. management tends to view the workforce as something that can be bought and sold, whereas the Japanese manager typically views the workforce as something to invest in, to nurture, and to develop and where a long-term relationship is assumed. Workers are a major asset which you cannot buy, cannot sell, you've got to grow like a very carefully developed Bonsai tree.

The Japanese philosophy in this regard is closer to the European approach than our own. I think we are going to continue to have these problems; until we change our present approach.

Mr. **Prewitt**. Congressman Walgren.

Mr. **Walgren**. Two questions: One is: Given the difficulty of transferring foreign methods of doing business into our environment, has anybody researched the success of the foreign companies doing business in our economy? Is it too early to ask whether they're having success in transferring their methods of doing business to this country?

And the second question is: Can anybody make an estimate of the degree to which the Federal government has been used as an excuse for American management not to perform as well as it might, compared to other societies which might not have such an adversary relationship, and which might redirect their energies in more productive ways?

Mr. **Ouchi**. Let me comment on both of those issues.

First of all, with respect to the question of the Japanese form of management operating in the U.S., I've done two things: One is to have several years ago, when it was still new, visited many Japanese firms in the U.S. And number two, is to have a doctoral student who spent six months in Brazil comparing the way in which American and Japanese firms introduced themselves into Brazil.

What we have found consistently is that the Japanese firms have been very successful in taking a slightly modified, in each case, form of their approach to organization and management, and introducing it into a new society. Now there have been—that's not to say they have been without problems. They have had a lot of difficulty, particularly at the top levels, having American managers become sufficiently familiar with the underlying subleties of the Japanese organization to be able to cope with it successfully. And they have, in some cases, adopted some high-cost solutions such as assigning Japanese coordinators to each of the top American managers. Basically, I think two people for each job. But nonetheless, they have by and large been quite successful.

Now, on the issue of government, there is a widely discussed position which a firm argues—particularly the Ministry of International Trade and Industry in Japan, is an elite corps that knows all, sees all and tells everybody what to do. Basically the central planning model.

This is one of the issues that we are now beginning to look at in greater depth. My reaction at this point, which is a preliminary one, is that that's not an accurate depiction of the relationship that in fact there is an adversarial relationship between business and government in Japan. But, it is of a quite different form than we have in the U.S.

It is a relationship that is mediated through a structure of associations that ends up providing a very effective dialogue. For instance, it is typically the case in the U.S. that when a new question, say of technology, arises, there will be perhaps 25 firms in the industry which will be affected. Each of them will seek to influence the subcommittee working on the legislation, or the regulatory body which will be swamped with 25 individual companies coming in, each with its own position. And there will be sufficient chaos, typically, that nothing happens. Or that all of the noise gets ignored.

Well, rarely will that happen in the electronics industry in Japan. There is a network of trade associations that play a very important role. The firm that has the issue in mind will first have to go to its local trade association that consists of, say, 10 or 15 firms who have very homogeneous interests, and will have to work out a position within that group, form a consensus, just as they would within the management of the firm. That means there will be some give and take. But it means once the issue is resolved within that group, it has the support of the group and they will all stand still when the solution comes down.

That group then takes it to a geographical association which represents all the industries in the geographical region, and they will look at it from the standpoint of all the other industries and again work out an acceptable position.

And they will ultimately go to a national association and again be looked at from a national point of view.

And then it will go to the Ministry of the Legislative Committee in question. By the time it gets there, the government people they are dealing with know that this is not capricious, they know that they aren't going to get 35 variations on a theme, and they are able to engage in a dialogue that, in my view, is a far more efficient one.

So, I think that there are some very real differences there. We have so far located 90 associations that serve the U.S. electronics industries. Their role, as far as I can tell at this moment, is in some respects similar, but fundamentally quite different from the role of those associations in Japan. I can't tell you right now just what that is, but in another year or two I will be able to.

Mr. PREWITT. Congressman Walgren's questions were, I think, particularly critical. Perhaps I can turn to the other members of the panel so that they might add to it.

Mr. COLE. I just want to make a comment on the first question, and lest we seem to agree too strongly up here, let me take a little bit of issue with Bill.

I think there is an enormous hype job being done with respect to the activities of Japanese firms in the U.S. primarily by the journalists, because it doesn't make very good copy to write that they are basically trying to do the same thing American firms do. Not a very interesting story.

My own impression, having visited numerous Japanese firms, is that Japanese management in the U.S., first of all, is extraordinarily conservative, extraordinarily interested in adopting local practice and melting in. They are very nervous about managing a multi-ethnic labor force, scared to death of unions, and very careful.

There are some rather flamboyant firms—and I recall being on a platform with a manager of one who went on at some length about the mystical and wonderful Japanese way of doing things. At the same time he was doing that, I learned later that the workers were voting to join the Cement Workers' Union. [Laughter.]

Having said that, let me back off on two points. Two areas where I do see some significant differences are: In the area of quality where They are replicating very well their concern and commitment to quality. I interpret that as basically a matter of management priorities.

If there is a strong management priority for high-quality products it will happen. It will happen in a U.S. firm as well as a Japanese firm. I see that being manifested in their practices in the U.S. I conclude that the notion that somehow you can't maintain high Japanese quality with U.S. workers, is not terribly useful.

The second point where I see a significant difference is in a greater commitment to keep people on the payrolls during economic downturns—it is not an all or nothing proposition, but they will go that extra mile. They will go a little further than a U.S. corporation will to hang on to that labor force with the expectation that they will need them later, and that those workers will reward them in effect for having gone that extra mile, in terms of greater loyalty. There's a clear payoff there.

Mr. PREWITT. Bill Abernathy, do you want to add to that?

Mr. ABERNATHY. Just to set the record straight a little bit, I don't think all the credit goes to Japanese management. There are some factual difference between the Japanese system and the U.S. system. Japanese firms, in contrast to U.S. firms, tend to assume, that their government is going to operate in their economic interest.

I think it is pretty generally true that, for example, MITI, the German government and the French government operated in the economic interests of their industrial firms. In the past it would not necessarily have been correct for the U.S. businessman to assume that the government was going to operate in his economic interest. The U.S. government may have operated in the nation's environmental interest or the public's interest, but the needs of industrial forms did not receive a high priority. There has been a lot of difference in the behavior of the nation's respective governments. There was some reason for U.S. businessmen to be a little bit nervous about someone who would knock at the door and say, I'm from the government, I'm here to help you. [Laughter]

There have been difference in intentions, which I think is appropriate in our system. I am not criticizing. But, our system doesn't lead to the same kind of cooperative relationship that you see either in Europe or in Japan.

Mr. PREWITT. I will stick with the ethos of this building, and allow the members of the panel if you will, or of the subcommittee, to continue to ask questions, if they would like to.

Mr. SEIBERLING. I want to follow up on Mr. Walgren's line of questioning.

It seems to me what Professor Ouchi has described in terms of the way the industries get together and decide what to do about a new product line, for example, would clearly violate the antitrust laws of the United States. And I wonder if the panel could tell us to what extent they feel that our antitrust laws make imitation of Japanese practices along those lines impossible. Could this indeed be the source of the original antagonisms to government and industry.

Mr. OUCHI. Well, I'm sorry I have to say this, but that happens to be one of the questions that we are trying to get smart about right now, and I am not sufficiently familiar at this point with the antitrust situation in the U.S. to be able to give you a good answer, except to point out that it is widely believed among American managers, that the slightest attempt at cooperation and technology, or in political influence, is going to be jumped on by various and sundry parties within the federal government.

Now it seems to me that the underlying issue is that in the U.S., the man and the woman on the street are sufficiently uninformed about what happens in business, that they don't understand the objectives of firms, not the conduct within firms.

And not understanding, they naturally fail to trust them. Failing to trust them, they naturally ask the government to keep a close eye on them in order to make sure there are no shenanigans going on.

The process of keeping an eye, is one that inevitably produces a bureaucratization of the society.

Now, unfortunately, there isn't a solution except one, which simultaneously satisfies the public interest to have an effective monitoring system, while at the same time providing flexibility within which firms can arrange their affairs in an efficient manner.

The only thing, I think, one can say clearly at this point is that the solutions we have worked out as a nation up until this point, are not serving us very well. What the shape of the new solutions is going to be, is something that I, at least, can't say at this point.

Mr. PREWITT. On this antitrust issues, do any of the other members of the panel want to speak?

Mr. ABERNATHY. I think I disagree with that a little bit. We tend to credit Japanese institutions with a lot more power and sophistication then maybe warranted because of their general success, It occurs to me that these sophisticated group arrangements, like the Mitsubishi group, or the Mitsubemi, whatever it is, do not have a terribly strong record of innovation themselves.

When you ask the question, how many radical innovations have these groups created, the answer is not very many. They are great imitators and great copiers, which worries MITI to death. And MITI's great job is to boost Japan by its shoestrings in terms of innovation.

It is not clear to me that we want to create a group think situation like the one that exists in Japan. Our great national strength has been in our innovative ability, our kind of independent ability to think creatively.

I think by collapsing all the antitrust rules, we may be imitating without emulating.

Mr. OUCHI. I am sorry, but I can't let that one go by. [Laughter.]

In 1975, I spoke with the president of one of the leading U.S. semiconductor houses, probably our leading edge of high technology. And this gentleman said to me, you know the so-called bonded Japanese system has the great defect, that it is incapable of supporting the maverick, deviant, the creator. It is not capable of turning on a dime, and that is why the so-called Japanese threat in semiconductors has never developed. [Laughter.]

Number two, it is my view that if you were a rational manager in Japan in the 1950s, you had a choice of either reinventing the technological wheel, or borrowing the design from the U.S. And the fact that the Japanese have borrowed technology from us up until now, simply demonstrates that they are not irrational. We have yet to see whether the form of organization that is different, is one that is capable of innovation.

Mr. **PREWITT**. I would like to welcome Congressman Richmond to the seminar.

Mr. **SHAMANSKY**. If you could please comment on the apparent willingness of American companies to grow by virtue of merger the idea that they acquire something, so they can report to the stockholders, "We have increased our volume," can be distinguished from really going out and marketing better to increase their share of the market by developing a better product. You don't even have to limit it to developing a better product rather, being sensitive to the market and simply doing a better job at selling. It seems to me the Japanese firms have been successful finding out what the American market wants and delivering just that.

Would you speculate as to why the American companies haven't been as sensitive as the Japanese companies.

Mr. **OUCHI**. Well, I think there are two kinds of merger issues that are relevant. One is the vertical and the other is the horizontal, which are quite different cases.

And what you refer to is that there is some suggestive evidence, and I should say that it is only suggestive, and I wouldn't be at all surprised if a number of people would stand up and loudly disagree with the statement I'm about to make.

There is some suggestive evidence in the last several years of research on American firms, which suggest those that have grown by horizontal merger and most highly diversified, indeed tend to be low-profit performers over the long run.

I think the answer is one that goes back to a big difference in the structure of capital markets. In particular, individuals in Japan have an incentive to deposit savings in financial institutions, because if they do so, the dividend payments that they receive on the first several thousand dollars of deposits are tax free.

Now what that means is, to an extent it is quite different from the U.S., it is the large banks and financial institutions which control the capital markets. Because those large financial institutions are closely allied with industry groups, because they know the business of those groups, they aren't terribly easily fooled by financial legerdemain that may make it appear that earnings are rising rapidly whereas, in fact, anyone who understands the business knows that they really aren't.

Now, if on the other hand, you have the situation that we have in the U.S., in which stock ownership is typically very highly dispersed, then you have a set of 100,000 shareholders, each of whom owns, say, 500 shares, none of whom has the incentive, the time or the expertise to become aware of the underlying needs of the firm.

Now, in that condition, people say to the company, all I want to see is a steady increase in quarterly earnings. And if you don't show me that then we will organize and throw you rascals out.

Now, what happens is that the firm in the U.S. may say, what we should do is to make what is going to be a 15-year investment in technology X. But the shareholders will say, well, if you would like us to fire you, go right ahead and do that. That's not a terribly good incentive.

Mr. **Shamansky**. Don't you think the stockholders are beginning to realize that the short-term is bad in the long run? [Laughter.]

Mr. **Ouchi**. That's right. Well, in fact, there are, as you know, social traps in which it paradoxically becomes more reasonable for each individual to take an action that ends up hurting all of them in the long run. And that, I think, is in part what happens.

Mr. **Shamansky**. Does the demand come from the 500-share stockholder, or the managers of the institutional portfolio?

Mr. **Ouchi**. I think it comes about in part from those specialists in financial analysis, most of whom reside in New York and Chicago, each of whom follows a set of perhaps 100 firms in two industries, visits each firm once a year for a day and a half, and other than that reads Quarterly Earnings Report, and sends out their advice to all the shareholders and institutional owners.

Mr. **Prewitt**. Professor Cole?

Mr. **Cole**. I just want to make one comment, that actually relates to the preceding question. It involved a distinction that I consider rather insidious. It is a distinction between imitation and innovation. For my money, that is one of the more useless distinctions made.

In the process of borrowing Western technology hardware and software, the Japanese have displayed incredibly good innovative capacities. In many ways they are doing to us what we did to Western Europe for 100 years. The Western Europeans used to say, "We invented this and we invented that and we still have a technological edge."

Meanwhile, we were commercializing those inventions, improving on them in all sorts of ways and establishing our world leadership.

The Japanese are doing the same thing to us today. We ought to be able to recognize that historical process.

Mr. **Prewitt**. Bruce Smith, who I might say introducing him, is a Professor at Columbia University working at Brookings Institute on issues of R. & D., science policy and so forth.

Mr. **Smith**. Ken, I just think Professor Cole's last comment notwithstanding, I think there is quite a serious error which we have fallen into here.

Several allusions have been made to the semiconductor industry, and some chuckles were expressed a few moments ago.

In fact, the Japanese semiconductor industry is not at this time a serious challenge to the U.S. semiconductor industry. U.S. semiconductor industry, the whole microelectronics—we are as progressive in that area as we were rather complacent and retrograde in the old fashioned consumer industry. But right now we are still about two-thirds of the world market, which is extraordinary, considering the enormous investment which the Japanese have poured into

Nippon Electric, given tremendous favorable financial treatment by their banks.

But I would not think that it should be assumed that maybe over years and years and years if Nippon Electric continues to get underwritten even when its performance is worse than Chrysler by a long way, something will happen. But, we should not neglect our own great innovative industries, among which the semiconductor industry is one of the most extraordinary stories in the history of American industry.

Mr. PREWITT. As Congressman Richmond reminds us, there is a matter of factual dispute here as to how well we are doing in our semiconductor industry; 40 percent import now?

Mr. RICHMOND. We understand 40 percent of all conductors in the United States are being imported from Japan. I'd say that indicates they are quite a challenge.

Mr. SMITH. Two thirds of the world market is U.S., and if the Japanese would open up their markets, we would sweep through Japan and dominate theirs.

Mr. RICHMOND. Bruce, why are we importing 40 percent of our conductors from Japan?

Mr. SMITH. I think there is something a little bit misleading in that figure. I think that's a mistake.

I've been dealing with our semiconductor people and I never heard that figure. I don't know how that——

Mr. RICHMOND. That figure comes from the expert testimony we got from the industry before our Joint Economic Committee.

Mr. PREWITT. I'm going to conclude with one more question, if I might.

Mr. FRENCH. I am LaVon French, counsel to the Small Business Committee, which is a good preface to my question.

Most of your conclusions seem to have been applied toward larger firms. Given the exceptional contribution of small businesses to innovation in this country, would you draw other conclusions as to the size of firms?

Would there be a different story?

Do you have something new to add or that you found about small businesses?

Mr. COLE. I will just make one comment based on work in the automobile industry.

You know, a lot of the conclusions that were reached about the cost advantage of Japanese are based on looking at final assembly operations in the major manufacturing firms. And the assumption has been that this is duplicated in the other half of the supplies industry.

And we have also had the notion that there were a lot of mom and pop kinds of firms in the supplies industry in Japan that in effect subsidized the larger firms with lower wages and so on and so forth.

As I look more and more—this is part of a new study that I am getting involved with on manufacturer-supplier relationships—I am prepared to consider the possibility that the productivity gap may be even worse comparing their suppliers, to the American counterparts.

One of the striking characteristics in Japan, partially because of this satellite arrangement that Bill referred to, is the fact that they work with their vendors with a tremendous exchange of technical, economic and managerial information, so that there has been a remarkable upgrading certainly in the automobile industry, and I would expect in many other industries, in the capacity of those supplier firms. This upgrading has led to an extraordinary increase in productivity in those firms.

Mr. PREWITT. Before turning the podium back over to Dr. Bromley, I would like to ask Bill Wells, from the AAAS, the Office of Public Sector Programs, who has been largely responsible for organizing this seminar.

Bill, do you want to add a comment?

Mr. WELLS. Well, there was one question I was going to put in the form of both a question and a comment. The current tax proposal before the Congress for research and development, the 25 percent credit for R. & D., unfortunately as it is proposed by this administration, excludes social sciences from that tax credit.

I'd like to have an opinion from our panel as to—[Laughter.]

Mr. PREWITT. Would anyone like to predict the opinion you are likely to get? [Laughter.]

Mr. OUCHI. Let me offer simply one observation on that: It is often observed that 75 percent of the industrial robots in use in the world today are in use in Japan. And that there are 126 companies in Japan manufacturing industrial robots, as opposed to approximately six in the U.S.

And this is taken to demonstrate how important it is that we have additional investment in that kind of manufacturing of hardware in the U.S.

Let me observe in addition, that an industrial robot is a terribly stupid thing. You can't simply have an engineer design one, put it in place and have it do a job. You cannot have it in place unless you have an exquisite kind of cooperation between labor and management, so that the people performing the job manually are willing to engage themselves in assisting the engineers, in assisting the firm in figuring out exactly how to put those things in place so they will work effectively.

We don't need to ask any further than the infamous story of the Vega plant in Lordstown, Ohio, which was one of the first great industrial robot experiments in the U.S. to see the importance of that managerial-labor relationship in having those capital investments succeed. And it seems to me to put all the eggs in that basket is simply to shoot ourselves in the foot.

Mr. PREWITT. I will take a shot at Bill's question. One of the things that we have learned is that in the long run, at least in a society which is a reasoning society such as ours, all science is applied science. You don't know when you start out on a piece of research the way in which it will be applied. But, this is a society which takes advantage of knowledge, information, insights, concepts, measurement strategies and so forth.

And the record, I think, over the last 30, 40 years is quite clear that we eventually, I think, make fairly effective use of that which our science produces for us.

And I am obviously gratified, as we all are, at the willingness of the Subcommittee on Science, Research and Technology, the full committee, for sponsoring this seminar. I would like to make the observation that the subcommittee chaired by Doug Walgren will continue this seminar in a series of formal hearings under the same title, starting on September 9th, running about seven or eight days, and Mr. Lundine will chair the hearings.

With that, I would like to turn this over to Allan Bromley, with our appreciation, AAAS, for its service.

Mr. **Bromley**. Thank you, Ken.

We have heard much today about research, we have heard from three of the country's pioneers in one of the very vitally important areas of innovation. In closing this seminar I want to share with you a quote which doesn't say very much about research, but says a lot about American education.

I have a graduate student who has the benefit of an Ivy League undergraduate training. He is going to be a great physicist with a Yale degree. And the first sentence in his dissertation thesis draft was as follows:

"This field of research is so virginal that no human eyeball has ever set foot in it." [Laughter.]

Mr. **Bromley**. Thank you very much. [Applause.]

[Whereupon, at 2p.m., the hearing was adjourned.]

APPENDIX II

Statement of Dr. Anthony P. Carnevale
on behalf of
American Society for Training and Development

My name is Anthony Carnevale. I am here to testify for the American Society for Training and Development (ASTD). ASTD is a national institution representing a diverse mix of over 40,000 individual members and 129 local chapters involved in human resource development in both public and private firms and educational institutions.

This testimony is submitted in the interest of promoting dialogue over the role of the human factor in the nation's economic future. My remarks do not represent an affirmed ASTD position or a definitive prescription. Rather, they are offered as a basis for stimulating new conceptual approaches to encourage a better understanding of the potential role of human capital in the nation's economic scheme.

This testimony offers a novel perspective on the appropriate role for a human capital perspective in economic policy. As such, it will be necessary for me to review the current crisis in economic policy -- in our ability to manage the nation's economy and to provide for a successful economic future. As will become apparent, it is my view that current economic policies fail and will continue to fail, in part, because they do not recognize the economic importance of the human factor in production. I will assert that an alternative mix of economic policy levers is preferable to those currently in use. Principle among those alternative levers is a human capital policy that will both assure lifetime opportunities for the nation's citizenry and a productive economy.

In theory, the role of human capital in promoting an efficient and productive economy is well established. In practice, however, the economic importance of human capital goes virtually unrecognized. Human capital policies are not so much opposed as ignored.

There is evidence that human capital will not be ignored in the future. The evidence of which I speak is a fundamental shift in the focus of public policy.

That shift is the reformulation of current policies, programs and public institutions in order to promote the overall health of the American economy. The clearest indication of that shift is the buzz of awkward new phrases that clutter the current public debate: supply side economics, reindustrialization, revitalization, industrial policy and so on.

The current economic debate focuses on alternative approaches to remedy our economic "malaise." On the one hand are the traditional economic policy makers. They do not divide neatly by party affiliation or political persuasion. There are Republicans, Democrats, liberals and conservatives among them.

Traditionally, economic policy has been limited to manipulations of the overall amount of income available for spending (demand) and the overall supply of money. Until recently, it was generally agreed that when the nation's resources were not fully utilized, increased spending and easy money would increase employment and productivity. Correspondingly, when people and other resources were more fully employed, tight money and reduced spending would cool an over-heated and inflationary economy.

Traditional economic policy makers still cling to these policies. They explain that apparent failures are due to lack of resolve and persistence. According to them, growth requires unprecedented stimulus -- stable prices, a more dogged restraint. If the nail won't go, get a bigger hammer. Traditional economic policy makers show an excessive concern for the impact of wage increases on prices while, at the same time, ignoring the possibility for anti-inflationary increases in productivity and competitive advantage that come with the labor force.

What concerns me most is that traditional economic policy makers seem to be in agreement that the only economic role possible for human capital policies is, at best, to provide a social safety net to maintain those who do not share in the largesse of the American economy and, at worst, as budgetary cannon fodder in the war against inflation.

So long as economic policy ignores the importance of human capital in the overall performance of the economy, there is little hope that the fundamental economic importance of the human factor in economic growth will be recognized.

There is a different view that has finally arrived. An emerging and expanded view of economic policy recognizes the nation's public and private education and training systems as a full partner in economic policy. The new economic thinking recognizes the necessity for education and training infrastructure in the development of human economic capital. Proponents of a new economics know that as a matter of course we need to improve the productive quality of the American work force, expedite its continuous integration with new technologies and expedite the rate at which we respond to the changing relative prices between labor and other factors of production.

In my view, the future of education and training, indeed the future of the American economy, lies with this expanded vision for economic policy.

What I hope to do here today is to give you a perspective through and beyond the current economic debate and the battle of the budget, to demands that surely will be made on you as traditional economic policies give way to the more urgent realities of the current economic "malaise."

Let me begin with some general remarks as to where we've been as an economy and where we are.

The Historical Roots to Our Current Economic Malaise

By 1941, the United States was a major military power. The Second World War unleashed our economic leap forward and gradually gave birth to a new social optimism based on our economic success. The hothouse economy of the post-war boom made it seem that we could produce abundance on such a scale that social problems would drown in a sea of resources. Social conflict, and the ideologies that fed upon it, would be abolished forever. By all reports, our principle problem as we ran pell mell towards the post-industrial society was to provide for meaningful leisure.

Without repeating the familiar litany of decline, suffice it to say that things have changed for the worse since the 1940's.

If our current policies are ill founded, our concern is not misplaced. We are finally beginning to react to economic decline. After ignoring our industrial base and presuming our economic invulnerability, Americans have been jolted into the realization that we need to attend to the care and feeding of our economy. America's basic economic problems are no longer the exclusive province of wide-eyed futurists and academic economists. We were all warned, but it was only when the Arab oil embargo convulsed us into gas lines and an 18% rate of inflation that each of us wondered if this first mild economic stroke was not the harbinger of something worse.

It is commonly explained that our current economic malaise is little more than the evidence of our inevitable adjustment to changing circumstances in the international economy. Descriptive explanations of our current economic status, however, beg the question. The real question is how, with our massive economic lead, natural abundance and trained work force, did we lose our economic preeminence in the world. The answer, in my view, is that our economy has not been able to adapt as quickly as our competitors to the opportunities for production appropriate to an advanced industrial economy. That failure begins with our outworn insistence on economic policies that no longer square with domestic economic organization or the realities of modern day international competition.

It is my view that the seeds to our current insistence on outworn policies were sewn by our dramatic successes of the past forty years. The snake in our garden of successes has been success itself. Experience taught us facile and aloof economic policies that encouraged ignorance of the actual engine of economic growth. An important cog in that engine is the self-conscious development of a productive workforce.

In the late 1940's, the abundance of resources organized for war production remained stimulated during the post-war era by the pent up demand for consumer goods that war wages provided. The result has been 40 years of relatively effortless growth. As a result, we have been able to largely ignore resource mobilization, the development of human and machine capital, and the process of production itself. Instead, we have leveraged the mobilization of resources and the application of technology remotely and neutrally through the management of demand. To oversimplify somewhat, we have stimulated economic growth and tempered inflation at arms length by moderating the amount of income available for spending. Spending translated into demand for goods and services and stimluated production. Production generated employment and wages available for more spending -- which created more production and more wages. If the self-sustaining upward spiral of economic growth wasn't moving fast enough, we nudged it with broadly based stimulus -- usually in the form of tax cuts. If the spiral spun upward too quickly, we slowed it and the rate of inflation by bleeding money out of the economy until production and income growth achieved some rough balance.

Income growth also resulted in public revenues which had to be spent eventually lest they act as a fiscal drag on the economy. Fiscal drag proved a happy problem. We tended to use public revenues to maintain or compensate those who, for one reason or another, didn't share in the economy's largesse. Government policies, especially federal policies, and especially federal human resource policies, evolved as arbiters of economic quality, and not for the promotion of human capital development or economic efficiency.

Public revenues could be used to paper over the social failures of production and to pay for its negative external effects.

Our economic system seemed to have the self-sustaining power and perfection of a social gyro. Once set in motion it spun free at ever accelerating rates. Production generated income which in turn encouraged production. All that was required of economic policy was to brake or nudge the spinning wheel. Moreover, public interventions could be neutral and remote from production itself. The public sector eocnomic levers braked or nudged the free spinning economic wheel externally at the point of demand. Economically minded policies for the general development of human capital, resource management and the integration of labor and new technologies were unnecessary.

The current economic malaise stems from the fact that our human capital, natural resources and industrial plants have reached the limits of their productive capacity. As a result, we face declining economic opportunities abroad and severe economic discontinuities at home. Moreover, it has become apparent that our current economic malaise does not stem from a lack of resources, but from our inability to capitalize on available economic opportunities and to the shifting relative prices among the mix of resources necessary to production.

American technological and natural resources are second to none. Our difficulty is the non-competitive rate at which we apply technology to production and the non-competitive rate at which we integrate human and machine capital in the interest of economic efficiency. What has been most disturbing is that neither the natural equilibrating mechanisms of the market nor our current demand-centered economic policies have been particularly successful in encouraging adaption to new resource mixes or the rapid application of new technology. Our current demand-centered policy levers were born in an era of effortless growth and are no longer sufficient in an era when growth must be self-conscious. We need to add some new strings to our economic policy bow.

The Macro-Economic Policy Trap

Increasingly, liberal and conservative economists agree that our traditional manipulations of the overall level of spending and money supply have less and less positive impact on real growth, prices, productivity, and employment. Explanations for the failure of traditional macro-economic policy vary, but analysts agree that persistent and indiscriminate restraint in the form of tight money and high interest rates eventually results in economic stagnancy harming the long-term health of the economy. At the same time, a persistent and indiscriminate stimulus in the form of increased spending and easy money eventually results in inflation. As a result, policy makers face an exasperating dilemma where neither persistent restraint nor persistent stimulus seems advisable. Analysts of various political persuasion suggest that we escape the current economic policy dilemma by reducing our reliance on traditional policies, complementing them with what are variously called "supply side" policies by conservatives or "structural" policies by liberals. A suggested "human capital" policy is generally among those recommended "supply side" or "structural" policies.

Traditional economic policies fail because they stumble into the "macro-economic policy trap." The trap consists of an over reliance on broad-brush fiscal and monetary restraint. The result is an unavoidable vacillation between restrictive and expansionary policies. Restrictive policies end prematurely when they create intolerable unemployment and unconscionable interest rates. Expansionary policies are choked off prematurely when they result in an astronomical inflation. Neither the restraint nor the stimulus ever achieves its desired effect. The trap closes as a persistent inflation reduces the allowable stimulus and economic stagnancy makes aggressive restraint unwise. In the limit, neither stimulus nor restraint is possible.

Stagflation is the elusive quarry that draws us into that trap. This hybrid calamity is the new test for economic policy. We no longer face the luxury of single-minded assaults on either inflation or stagnant growth. A single-minded broad-brush stimulus is inevitably inflationary because it falls equally on fertile and fallow fields. A single-minded broad-brush restraint frustrates possibilities for productive growth as much as it curbs inflation.

Our national and international economies are less responsive to traditional macro-economic policy tools. The free-flowing international market place has long since been replaced by a system of government-to-government trade patterns and the aggressive intervention of multinationals which dwarf most governments in size and power. Scarcity in natural resources, the need for new product markets for developed nations and the new independence of resource-rich underdeveloped countries can only accelerate that trend.

At home, the "invisible hand of the marketplact" has been slowed by the "invisible handshake." Economic decisions are determined by a complex set of relationships and expectations between firms, workers and customers. As a result, wage, price and production decisions are increasingly independent of overall economic conditions.

The effect of this complex economic reality is evident in the intransigence of the current inflation, in the face of traditional monetary and fiscal restraint. We reduce demand but wage and price decisions appear increasingly independent of overall demand conditions. The mutual trust and loyalty between firms and their workers and customers -- not to mention the cost of finding and training workers and cultivating customers -- makes firms loath to disrupt expected patterns in wages and prices. Other factors such as multi-year wage contracts, wage and price indexing, cost-plus pricing and the publicly provided social safety net further reduce the leverage in traditional demand restraint.

The intransigence of the current inflation in the face of traditional economic restraint is evident in the increasing economic and social costs exacted for marginal reductions in wages and prices. We now must keep one million people out of work for two years and sacrifice $200 billion in economic output in order to reduce the rate of inflation by one percent. In addition, traditional restraint that results in unemployment proves self-defeating. We add $27 billion to the federal deficit in lost revenues and the price of income support payments for every single percentage increase in unemployment.

Eventually the single-minded emphasis on overall fiscal and monetary restraint fails. The effects of such policies overwhelm the nation's social and economic capacity to pay for them. At some point, policies move abruptly from aggressive restraint to an emergency stimulus. The government inevitably falls into a pattern of stop/go policies disruptive of consumer and investor confidence.

Escaping The Macro-Economic Policy Trap

Alternating between broad-brush stimulus and indiscriminate restraint has proven too blunt an economic policy tool. The only way to break the back of the current stagflation is with a program that carefully balances stimulus and restraint. More targeted policies are required to remedy the simultaneous price inflation and economic stagnancy that currently afflict the American economy. We must carefully target restraint on inflationary sectors and target stimulus where non-inflationary growth is possible. Meat-axe budget cutting must give way to a close assessment of the economic importance of individual programs and tax expenditures.

We must add new strings to strengthen our economic policy bow. The structure of the domestic economy requires new policies and new institutions to supplement traditional monetary and fiscal policies. There must be new modes of cooperation among government, labor and management to substitute for old antagonisms. We need to consider an incomes policy to supplement monetary and fiscal restraint. We need to experiment with policies to promote economic revitalization ranging from industrial policy to proposals for encouraging regional, state and local development. We need to begin thinking seriously about human capital.

In a similar fashion, the increased complexity in the international economy will require a more aggressive promotion of American products abroad. It may be necessary to promote careful cultivation of foreign customers and economic cooperation with producers of materials vital to domestic production.

In my remaining remarks I will briefly discuss monetary and fiscal policies. Afterwards, I will briefly discuss a range of "structural" or "supply side" policies -- the crucial third element in any successful economic policy. The concluding portion of my remarks will focus on human capital -- one particular set of "structural" or "supply side" policies of particular interest to myself and the American Society For Training and Development.

Monetary Policy

First, monetary policy: The current restrictive monetary policy is our anti-inflation program. We have no other. This singular reliance on monetary policy to fight inflation has led to an aggressive economic restraint. Astronomical interest rates are already closing savings and loans institutions and choking off housing starts. Excessive interest will undermind investment and employment possibilities in general. Eventually, I suspect, the harmful effects of the current restraint will force easier money. The nation will fall back into the cycle of stop/go policies that has been so destructive of investor confidence.

Alternatively, moderation in monetary restraint allows for more attainable monetary targets. Attainable targets allow for steady policies and a predictable environment conducive to business investment. At the same time, steady monetary policy persistently discourages inflation. Moderation in monetary restraint also avoids beggar-thy-neighbor interest rate wars. Interest rate wars erupt when any one nation relies excessively on monetary restraint to fight inflation, forcing other nations to follow suit in order to protect their currencies from devaluation.

Monetary policy should be more closely coordinated with other economic policy goals. At a minimum, the Reserve should explain its targets more fully and more often. One tack would be to set a common benchmark each year. The Reserve, the Congress and the administration could explain their respective monetary policies or changes in policy as deviations from that common benchmark. The simplest benchmark would be a money supply sufficient to maintain expected GNP and the unavoidable core rate of inflation. If money markets become sufficiently tight, it may be necessary to develop more articulate monetary and credit policies to ensure that traditional priorities such as housing and the revitalization of the civilian economy are not neglected. Eventually, aggressive monetary restraint may justify practices, such as those implemented in October of 1979, to discourage the use of scarce capital for speculative lending.

Fiscal Policy

I do not disagree that it is a reasonable public goal to reduce the growth share of GNP that derives from federal spending. I think we need to recognize, however, that it will be difficult to reduce the public presence if we are to simultaneously increase defense spending and maintain social insurance programs at some reasonable level.

We all need to be reminded occasionally that it is the economy that drives the budget and not the budget that drives the economy. For instance, every percentage increase in interest rates will cost us $10 billion in added deficits. Almost $250 billion in federal payments are indexed to the CPI, not to mention the added cost of doing public business that inflation encourages. A single percentage increase in inflation can add anywhere from $2 to $4 billion in governmental costs. A 1% increase in unemployment can add $27 billion to the deficit in the form of lost revenues and the added costs of safety net programs.

Fiscal policy is also a difficult lever in the war against inflation. Ten billion dollars in budget cuts are required to reduce inflation by one-tenth of one percent. Cuts of a sufficient size and quantity to appreciably reduce the current rate of inflation will be required far beyond that already made. They will be increasingly hard to come by.

I also favor expanded depreciation and other tax cuts targeted on productivity improvement. However, broadly based, multi-year consumer tax cuts are not advisable at this time. Such proposals, especially in combination with spending increases, risk an inflationary firestorm. Such proposals should be considered favorably only after we have made further progress against inflation, when the budget is under control and when other measures to improve the nation's productive capacity have succeeded to the point where we can accommodate a surge in consumer demand.

The Structural/Supply Side Alternative

Even sensible monetary and fiscal policies cannot achieve full employment without inflation. As a result, we need to supplement monetary and fiscal policy with a broad array of more direct and targeted "structural policies."

The complexity and competing nature of our economic goals demand new economic levers to supplement traditional monetary and fiscal policy. Single-minded monetary and fiscal restraint to reduce inflation is a case in point. The eradication of inflation is a primary goal. Yet, the organization of our economy resists sustained demand restraint. Overall demand conditions have less and less to do with wage and price decisions. It takes more and more demand restraint to effect smaller and smaller reductions in inflationary pressure. Eventually, the human and economic costs of sustained restraint are exorbitant and we back off. At the same time, goals other than stable prices cannot be ignored. These goals suffer under the yoke of restrictive anti-inflationary policies. As a nation, we are pledged to maintain our commitment to equal opportunity and a minimum quality of life for all Americans. We favor a strong military presence. We intend to revitalize our civilian economy in the face of intense international competition.

The competing policy demands of our economic goals result in policies which vacillate between attempts at aggressive restraint and the stimulus necessary for growth. The vacillation in policy results in an uncertain economic environment which is not conducive to investor confidence. Only moderation in restraint will allow for attainable monetary and fiscal targets and steady policies. If we are to simultaneously restrain inflation and allow appropriate growth, restraint must be moderate. Only moderation in monetary and fiscal restraint can reconcile a steady anti-inflationary policy with sustained expansion toward full employment, full production and higher productivity. Moreover, moderate restraint will bring only moderate price stability unless it is supplemented with a broad array of structural policies.

The dynamic core to such a set of anti-inflationary policies is an "incomes policy," an energy policy and a food policy. There are a variety of approaches to an incomes policy. Among the least intrusive is a system of tax-based incentives to allow benefits to workers and firms that meet voluntary guidelines. Energy and food policies are also necessary if we are to avoid the abrupt inflationary shocks characteristic of food and fuel.

A moderate restraint will allow a limited margin for growth. If we are to simultaneously maintain our commitment to equal opportunity and a minimum living standard for all Americans, a vigorous military presence in the world and a revitalized civilian economy, we dare not spend that margin foolishly. Use of the available growth margins must be carefully balanced among competing claims. Stimulus must be carefully targeted to emphasize America's competitive advantage in the international economy and the resource endowments peculiar to individual geographic areas.

Serious competitive problems in basic industries and area decline also suggest the need for targeted industrial and area policies. Over the past decade, our declining competitiveness has cost us more than $125 billion in lost output and over two million jobs. At a minimum, we need to develop an analytical capacity to assess the impact of government policies on individual industries and areas, and monitor domestic output, investment, trade and employment.

Democrats understand that industrial and area policies will be useless unless we can rid our economy of its rigidities and disincentives. Our first priority must be to enhance our industrial capacity and encourage productivity. Currently, the average age of our capital stock is 7.1 years. A substantial share of that stock was designed for an energy rich economy and is now outmoded. In addition, while our investment levels have not reduced markedly, an increasing share of our investment has been diverted from direct productivity inducements to the satisfaction of regulatory standards and to equip a rapidly expanding labor force.

As Pat Choate has pointed out in his testimony before this Committee, public capital is in ruins. One in five bridges needs to be replaced. More than one-half the nation's roads are in disrepair. According to the EPA, we need $150 billion worth of water treatment facilities if we are to comply with national purity standards.

Our investment in research and development has not kept pace. Throughout the past decade, American spending for research and development has kept pace with prior levels but our competitors have accelerated their R & D budgets. Moreover, America's research focus has always been on basic rather than applied research. Applied research turns ideas into marketable products.

We will have to pay more attention to our investment strategies in the future. Such scrutiny may require more sophisticated procedures than those that presently exist. One popular idea is the notion of capital budgets. A separate accounting of trends in capital investment would provide constant and timely information as to the current condition of our capital base and the future impact of our current policies. The 1978 Full Employment and Balanced Growth Act sets timetables and goals for lower rates of inflation and higher levels of unemployment. The time may have arrived for the inclusion of interest and investment targets -- the missing leg on a three legged stool.

The diversion of scarce capital to satisfy regulatory standards also suggests the need for a regulatory budget. Such a budget might constrain agencies to some maximum compliance cost in much the same way that the Congressional Budget Act constrains Congressional spending.

I do not agree, however, that we should eliminate regulation indiscriminately. Some forms of regulation are indeed superfluous and should be eliminated with all due speed. Other regulations, however, protect our health and safety and are desirable. It is pointless to talk of scrapping the regulatory process. Instead, we must make the process work by balancing social and economic considerations in the crafting and enforcement of regulations.

The keystone to the success of "structural policies" is increased cooperation among government, business and labor. Unless increased cooperation replaces the current friction, none of our economic policies can succeed. That cooperation begins with a commitment to retire habitual frictions. Cooperative arrangements may require new institutional forms, ranging from national coporations to factory and community based structures. A national Reconstruction Finance Corporation has been suggested. National and sub-national forums for individual industries have also received some attention, as have area development corporations and worker productivity circles. Such institutions provide vehicles for cooperation. They will work best where mutual interests prevail. The ambit of mutual interest between labor and management can be expanded through devices such as employee ownership plans and increased worker participation in capital formation through the prudent investment of pensions.

Human Capital

Inattention to the importance of human capital is the principle "supply side" or "structural" deficiency in our current economic policy. Happily, a suggested human capital policy is generally recommended among those who suggest "supply side" or "structural" expansion in economic policy. Such an expansion in economic policy would enlist both public and private education and training as an economic policy tool for the obvious purpose of encouraging productivity and growth and the less obvious purpose of stabilizing prices.

A human capital policy would represent a dramatic break with past practices. Unlike other industrialized nations, the United States has paid little public attention to the role of human capital in the nation's economic adaptability, productivity and competitive advantage. Instead, we have used public revenues to maintain those people, or places with concentrations of those people, who, for one reason or another, have not shared in the economy's largesse. Government policies, especially federal education, employment and training policies, evolved as arbiters of economic equity and not for the promotion of human capital development or economic efficiency. Public revenues could be used to paper over the social failures of production and to pay for its negative external effects.

The macro-economic case for human capital is convincing. Early work by Becher and Shultz in the 1950's and 60's suggested a greater return on human rather than machine capital. Subsequent analysis by Freeman noted reduced returns from human capital. Most recent analysis by Denison and Baily in 1979 points up that between 1948 and 1979 human capital improvements have accounted for an equal and perhaps a larger share of productivity growth than increases in machine capital per worker.

The contrasting conclusions from the work of Denison and Bailey and others, as compared to Freeman, raises interesting questions. It appears that returns from human capital have declined as Freeman points out. The work of these economists, however, suggests that the decline in returns from human capital is consistent with the general decline in productivity. In addition, the work done by Denison, Baily and others, suggests that Freeman's measured decline in the returns from human capital may result in part from our tendency to emphasize investment in general education over more specific production-oriented skills. In other words, the contrasting conclusions of Denison, Baily and others as compared to Freeman, suggest that Freeman's decline in economic returns from human capital result from the low overall levels of human capital investment and its lack of specificity. I would draw two speculative conclusions from the literature:

(1) Our underinvestment in human capital accounts for our current woeful rates of productivity growth as much, and perhaps more, than our underinvestment in machine capital. It follows that increased

investment in human capital will help reverse current productivity trends every bit as much, and perhaps more, than additional investments in machine capital.

(2) If we want to increase the economic returns from human capital investment, that investment must be more job-specific.

In any event, there is no apparent rationale for investment incentives that favor machines over human capital. In spite of that fact, current and proposed tax incentives are heavily biased toward machine capital. Human capital, for instance, is not depreciable, and human capital gains are fully and progressively taxed as income. It is likely that the current structure of investment incentives results in significant underinvestment in human capital.

The evidence that we have ignored and continue to ignore the economic importance of human capital is compelling. One striking bit of evidence is the dramatic rise in corporate expense for educational remediation and training. Recently, the Conference Board reported that 35% of the firms it studies now provide significant remedial training in reading, writing and arithmetic.

More general evidence of our neglect is available in an analysis of our current growth in employment. Between 1973 and 1979, we added about 13 million new non-agricultural jobs to the American economy, a remarkable achievement that far outstrips any of our competitors. Many take comfort in that fact as the final proof of the health of the American economic system. I do not. What disturbs me is that the growth was concentrated in low wage and low productivity jobs. These jobs offer short hours and low wages. They tend to be dead-end jobs. What is most disturbing is that they tend to concentrate among women and the new entrants to the labor market, upon whom our future productivity depends. In sum, most of the growth in the American economy is leading toward an economic structure characterized by badly paid and unproductive work.

With simultaneously high unemployment and periodic skill shortage, we have arrived at a perplexing point where neither the quantity of available work nor the quality of the work force is sufficient. While the disappointing overall growth in the American economy encourages unemployment and low skill/low wage work, high skill/high wage jobs go begging. What more, shortages are likely to become more severe.

Massive new public commitments to surges in defense and energy production will likely result in further shortages and consequent inflationary bottlenecks in production. We currently plan a surge in defense production three times that necessary to fight the Vietnam War and we intend to spend the money in roughly the same time span. Our military buildup guarantees that. In addition to policies to insure an available skilled work force for military production, we will need to carefully cater for the skill requirements of civilian industries lest they become starved for skilled workers and capital. A second-rate economic power cannot afford a worldwide military presence. Ultimately, it's the toasters that pay for the B-1 bombers.

The most disturbing evidence comes from a series of studies which suggest that our failing competitive advantage in foreign markets owes to our underinvestment in human capital. Most recently, the Bureau of International Labor Affairs reports that the decline in U.S. trade performance since the 1960s "is the result of differences in the growth of net real investment in equipment _and_ in the acquisition of labor skills through education and training." Between 1963 and 1975, the U.S. share of the world's skilled workers has fallen from 29% to 26%. Internationally, we have dropped from second to seventh in the "skill endowments" of our workers. The result of these ominous trends is that the skill content of American imports increases while American exports steadily lose their competitive advantage.

An accelerating economic change suggests that our tendency to ignore the economic importance of human capital will cost us dearly in the future. The coming decades will see rapidly changing industrial bases as national competitive advantage sorts itself out in an increasingly competitive world economy. High skill, high productivity industry will increasingly concentrate in industrialized nations. Low skill industry will concentrate in those developing nations that substitute labor-intensive production for technology in their first steps up the developmental ladder. We cannot match sweat equity with 952 million Chinese.

Competition for high technology production will increase among industrialized nations. That competition accelerates even now. Technological shifts can come with dizzying speed. Their implication for current modes of production and labor force requirement can be profound. For instance, if technological changes in Rolls Royce had proceeded at the same rate as changes in the electronics industry since the early 1970s, a Rolls Royce would be one and one-half feet in length, would travel up to speeds of 10 million miles per hour and would cost no more than $2.75.

We will maintain our international economic position only if we learn to continuously integrate new capital and labor to produce new products with newer, more efficient methods. What's more, as we become a more labor-intensive service oriented economy, advances in productivity may increasingly be embodied in human rather than machine capital. Moreover, the quality of American services will become more important as our economy will increasingly depend on its competitive advantage in service industries in international trade.

If we are to succeed, national economic policy must recognize labor as an economic resource to be developed and continuously refined.

A rapidly shifting industrial base and an accelerating international competition will increase the need for occupational and geographic mobility in the nation's labor force. Both will be more difficult as the labor force ages. Nothing threatens growth more than the proliferation of defensive "protectionist" measures to protect workers from structural changes. In order to avoid protectionism, we need a long term commitment to continuous skill upgrading, education and training for all workers.

We continue to ignore the importance of human capital in the overall performance of the economy at our peril:

-- In 1978, the share of the service sector in employment reached 68 percent and accounted for 66 percent of GNP. As we become a more labor-intensive service oriented economy, advances in productivity and competitive advantage will be increasingly embodied in people rather than machines.

-- In specific sectors such as the military, micro-electronics, micro-biology and energy equipment advances are rapidly outrunning advances in labor quality.

-- As the "baby boom" becomes the "baby bust", labor force growth will decline from 2.2 percent per annum between 1967 and 1978 to 0.9 percent between 1978 and 1990. In addition, growth will be greatest among disadvantaged women and minorities where the current human capital deficit is greatest. Unemployment will likely fall to 4.5 percent according to modest estimates, but wages and productivity are likely to remain low in the absence of significant increases in human capital investment.

-- The accelerating internationalization of the American economy will require a more skilled work force if we are to maintain and increase our competitive advantage in high skill production and continue to export labor intensive, low skill/low wage production.

-- The current defense and energy build-up will require policies to insure an available skilled work force to avoid inflationary production bottlenecks. In addition, we will need to carefully cater to the human capital requirements of civilian industrial access to skilled workers and capital.

If we are to expand our investment in human capital, additional education and training services will need to be delivered in envionments further removed from the traditional classroom and closer in substance and actual physical location to the world of work.

-- With the "baby bust" and receding incentives for early retirement the labor force will age. Increasingly, the training client will come as an adult with prior work history, ready for job-specific training with a minimum of remediation. Job-specific training, the province of the $40 billion private training industry, will become an increasing proportion of total education, training and retraining.

-- The human capital literature suggests that while the economic returns to human capital are high, they would be still higher if job-specific training represented a greater proportion of the nation's overall education, training and retraining effort.

The Effects of Current Policies On Human Capital

The nation's wage bill constitutes more than half our annual economic activity. Because of its importance as a share of economic activity and the visibility of wage decisions, anti-inflationary strategies have historically tended to concentrate on reducing the increase in wages as an indirect means of reducing prices. Historically, when fighting inflation, the Federal government has relied on restrictive monetary and fiscal policies to reduce demand and thereby reduce wages and prices. In the wake of failure, evidence mounts that demonstrates the irrelevance of overall demand conditions to individual wage and price decisions.

It appears that we are using people as cannon fodder in the war against inflation to no avail. The current reliance on restrictive demand policies encourages unemployment in the short term and discourages investment in the work force in the longer term. In short, our current policies have a doubly negative effect on the quantity of jobs and the quality of the work force.

The dynamics of anti-inflationary budget restraint is especially destructive of human capital. In order to reduce inflation one-tenth of one percent, for instance, we must eliminate some $10 billion in federal spending. These spending cuts inevitably fall on what little human capital development there is in the federal budget. The federal budget -- at roughly $600 billion plus -- seems huge, but in fact there's little room for cuts. Fifty percent of the budget is for income maintenance programs such as Social Security, unemployment compensation, retirement benefits and similar programs that have grown uncontrollably with eligibility. Seventy-five percent of this spending is for Social Security and Medicare. These benefits are mandated by law and are difficult to cut. While these programs provide resources to maintain individuals, they provide little in the way of human capital development.

Another quarter of the budget goes to the military. Theoretically, that money is perfectly cuttable, but in the practical politics of Congress, military spending is and will continue to be a sacred cow.

The remaining 25% includes virtually all state and local aid, in the form of education, employment, social services and economic development spending. While these programs hardly represent an ideal system for human capital development, they are the fiscal base upon which such a system might be built. Budget cuts inevitably focus on this final quarter of the federal budget, to the detriment of human capital development.

The federal deficit has very little to do with inflation, even Milton Friedman concedes this point. The current deficit is about 2% of GNP. In 1976, with inflation about half as high as current rates, the deficit was twice its current size. Nor is the national debt the culprit where inflation is concerned. The national debt has not grown as a percent of GNP. At $1 trillion, it's roughly 37% of current GNP. In 1960, the debt was only $290 billion -- 57% of that year's GNP of $506 billion.

The intransigence of our economic system in the face of anti-inflationary policies that attempt to fight inflation by increasing unemployment also result in a massive waste of human capital as we must use more and more unemployment to effect smaller and smaller reductions in inflation. Currently, in order to reduce inflation by 1% we must throw three million people out of work for three years.

Unemployment is bad politics and worse economics. The losses in human capital and eventually in economic productivity are mammoth. Current estimates suggest that as much as 30% of our current precipitous drop in productivity results from underemployment and unemployment of human capital.

In addition, the psychological impact of unemployment has its economic costs as well. Where unemployment is high so is economic insecurity. People in a high unemployment economy tend to find their security where they can. There is little risk taking when people live on the ragged edge of economic necessity. Insecurity discourages the movement from lesser to higher productivity enterprises. It also discourages self-initiated improvement in skills and training because an immediate economic payoff is not apparent. Alternatively, the economic security that comes with an economy more nearly at full employment provides longer planning horizons for both individuals and economic institutions. Security encourages risk taking. Security builds trust in economic futures. The trust and confidence in economic futures that comes with a measure of choice and opportunity that high levels of employment provides is of inestimable economic value.

The Japanese and some of our other competitors are willing to subsidize export prices in order to assure full employment at home, because they know the economic value of the longer term investment horizon for both labor and capital that full employment allows. We are not a full employment economy, in part, by choice.

Professor Phillips' curve that suggests a little unemployment could cure alot of inflation is a tired middle-aged liaison that no longer flatters Professor Phillips or ourselves. The direct budgetary costs of unemployment are tremendous. Maintaining even one million unemployed people costs as much as $25 billion in federal budget deficits in any single year -- roughly $10 billion in various support payments and $15 billion in lost revenues.

The current public debate over the safe and acceptable level of unemployment necessary to fight inflation is also instructed by consideration of the losses in national economic output that are occasioned by the persistent and high levels of unemployment suffered by the American economy over the past several years. According to the late Arthur Okun, for instance, our current anti-inflationary policies cost $200 billion in lost output for every single percentage reduction in inflation. In an analysis based on Okun's law, Professor Steven Sheffrin calculates that the failure of the American economy to sustain an unemployment rate equal to the 4.1 percent attained in the Eisenhower years has cost the nation more than $2.3 trillion in lost output.

The experience of European nations is equally instructive. The United States averaged 5.3 percent unemployment between 1959 and 1976. Over the same period, the comparable unemployment rate for France was 2.5 percent. Japan was 1.4 percent and West Germany was 1.2 percent. During the period in which world wide stagflation was at its peak, 1974-76, the American unemployment rate average 7.2 percent. We are caught in a vicious circle in our attempt to control inflation. Depressed demand in the interest of price stability atrophies our basic productive capacity and encourages the upward creep in the non-inflationary and thereby immutable rate of unemployment. That rate is now nearly 6.0 percent. As our human and physical resources wane, output declines further and unemployment rises. Broad gauged attempts at increasing employment through tax cuts and other general stimulus only result in further inflation as increased spending power falls equally on growing and stagnant industries.

An Alternative Policy Perspective

Economic policy must undergo a fundamental shift in perspective from viewing people as consumers and shareholders in dividing up the dividends of economic growth to a perspective that treats people as human capital -- productive factors of production. A case can be made that people are at the central cause of economic growth, not simply the recipients of its beneficence. Work done by Denison and others suggests that the lion's share of the productivity increases since the forties are due to the quality of the work force, and its successful integration with new capital. These effects are largely serendipitous in our recent history. We have relied on technology to further productivity gains, not human capital. Perhaps productivity returns from capital were sufficiently high until recently to justify ignoring the development of human capital. In any event, we have treated people as consumers or as potential consumers in need of the paycheck a job brings. A new perspective presumes a shift from aggregate job creation through demand stimulus, and targeted job creation through public programs to the development of human capital as a factor resource in the process of production.

From Maintenance and Protection to Development

The lion's share of our current human resources' policies fall into three categories. First, there are the programmatic and regulatory provisions that protect health and safety in the work environment and similar constraints that attempt to mollify the external effects of production on the general population. OSHA is an example of the first sort of worker protection and environmental constraints an example of the latter. Second, there is a set of human resource programs that maintain dependent, disadvantaged, retired, disabled and other populations that otherwise would not share in the nation's economic growth.

Until recently, our effortless growth allowed us to afford the loss in productivity that resulted from both sets of human resource policies. The American public had become sufficiently affluent to develop a taste for workplace and environmental protection. Our productivity was sufficiently great that we barely noticed the economic cost of that protection. In the case of maintenance programs, it seemed appropriate to supply a social net for those who momentarily lost work and to provide a share in the growth dividend for the disadvantaged, disabled and aged.

A third set of human resource programs attempt to provide equal economic opportunity for disadvantaged clientele. These programs attempt to increase educational attainment, provide remediation, job search assistance, training and direct employment. Measured in terms of their ability to provide increased income or private employment, these programs have been a mixed success at best. After years of effort, gains from compensatory education are beginning to appear. These gains have not had an appreciable effect on the lifetime income or labor market success of an increasingly disadvantaged clientele. Public job training and direct employment strategies have not been successful, largely due to their inability to successfully transition the disadvantaged to unsubsidized private employment. In truth, there has been little money spent on training -- roughly $500 per participant. Without sufficient training commitments, these programs are little more than elaborate devices for providing income maintenance.

The difficulty with all three kinds of human resource policies is that they are not self-consciously economic. Our human resources' protections, for instance, tend to set parameters on production rather than conditions for it. As such, they discourage fluidity in our economic system. Our current protections are not sufficiently dynamic to force choices between regulatory costs and economic benefits in the calculus of production. Instead, they are static and legislative. Environmentalism is a case in point. We tend to legally restrain pollution instead of developing a system of effluent changes that would incorporate the cost of a clean environment and not the cost of a particular product.

In addition, their policies and programs have served legitimate but single-minded goals. They evolved as attempts to effect an equitable distribution of economic growth. The evolved as devices for securing individual economic entitlement. As a nation, we have essentially agreed, I think, that everybody is entitled to their fair share of the economic pie. In the development of these human resources policies the concern was with the distribution of the economic pie. There was little concern with policies for promoting the development of human capital in the interest of efficient production or natural competitive advantage. In truth, there was little need for a developmental aspect to human resource programs because at their inception the economy seemed to supply all the necessary incentives and opportunity for human resource development without any encouragement more direct than demand stimulus.

The redistributive focus of early human resource policies was appropriate to an era of effortless growth. The essential problem of that era was to distribute the financial dividend that emanated from a growing economy. The redistributive focus of current policies is inappropriate to the modern economic era when growth is no longer effortless or homogenous among regions and demographic groupings. Instead, policies that emphasize the use of human resources as productive capital are required to boost the overall level of productivity and thereby encourage price stability and competitive production.

Human Capital: Principles for Policy Design

1. Promoting A Quality Labor Force -- The fundamental goal for human capital policies must be to promote quality in the American labor force in the interest of productivity, economic competitiveness and job opportunities for the structurally unemployed. There is no real choice between the requirements of a quality work force in general and the needs of the disadvantaged in particular. We cannot sacrifice the majority of workers for the sake of the minority and vice versa. The disadvantaged are still the first priority for public dollars and attention. Ultimately, we should keep in mind, their interest can best be served by policies that lead to an expansion in job availability through increased competitive advantage. The quality of the overall labor force is key in promoting that advantage. The public sector should and can maintain the disadvantaged and prepare the structurally unemployed for private job-specific training, but it can neither afford nor effectively deliver training and public jobs to the increasing number of unemployed and underemployed Americans.

2. Minimizing Costs -- Labor market policies can and should be largely paid for by the private firms and individuals that benefit from them. Programs for those most in need must be paid

for with public funds. Labor-force-wide policies need not be a substantial drain on public treasure. Labor force policies may entail the encouragement of public and private institutional and labor market efficiencies. Non-disadvantaged workers do not require expensive remediation or other forms of public assistance. Private firms do not generally require and, more importantly, are not generally responsive to public financial incentives. The essential difficulty is to match the available supply of human capital with private production needs and opportunities. Public institutions can catalyze and expedite the match between private needs and personal opportunities. Since much of the resultant benefit accrues to individuals and private firms, it is entirely conceivable these beneficiaries would be willing to pay a lion's share of the cost. Even the most expensive of such systems currently being discussed -- the German universal training subsidy -- is paid for by individual and firm wage and profit levies.

3. Public and Private Roles in Education and Training -- It is early yet for pronouncements on appropriate public and private roles in education and training. At the same time, the current distribution of education and training and activity suggests some shared conclusions. It seems generally agreed, for instance, that the private sector ought to take the lead where job specific train-

ing is concerned. A complementary public education and training system should give the work force the generic skills necessary for private job-specific training. Public education and training should be geared toward the current and future requirements of private economic activity.

Public and private responsibilities in education and training are not necessarily realized through traditional public delivery systems. Private job-specific training can be undertaken in public or in mixed public/private settings. Similarily, public education and training responsibilities can be met through tax and other incentives for private education and training rather than through expansion of existing public institutions.

Both public and private education and training are necessary. Neither will eclipse the other. Private training is the stuff of economic growth. As a result private education and training surges and recedes with the business cycle. Public effort can encourage the consistent quality of the entry level work force.

Ultimately, we need more cooperation between public and private entities. Cooperation will allow for an effective sorting of complimentary public and private roles. In addition, local and industry level cooperation will avoid the straitjacket of nationally determined roles and objectives. Moreover, public and private cooperation can be of mutual benefit. Public and private educators and trainers can find mutual profit in shared information, teachers, equipment for teaching and teaching facilities.

4. Retaining Private Initiative in Job-Specific Training -- The scope of policies for training and retraining a broad cross section of the labor force requires significant private sector participation. In addition, the industrial and geographic variability characteristic of the national economy would suggest a delivery system that emphasized the voluntary participation of individuals or firms. Interactive and non-bureaucratic devices that leave the initiative to participate with firms or individuals such as tax deductions, credits and vouchers would be preferrable to cumbersome and expensive publicly administered programs.

A variety of mechanisms that minimize public intervention have been proposed. Those that emphasize employee and employer cost sharing suggest themselves as the best devices to avoid abuses. Some possibilities for further investigation include: 1) A loan fund for job-related education and training could be made available to both firms and individuals. 2) An earmarked set-aside of payroll taxes could be utilized to provide continuous retraining for displaced experienced workers. 3) For the unemployed, participation in job search assistance, retraining and relocation could be a condition for initial or extended eligibility for unemployment insurance. 4) Firms could be provided a training tax credit. 5) Individuals could be given vouchers for retraining, especially when displacement is unusually concentrated or severe. 6) Tax credits could substitute for the current personal deduction for education and training. In addition, eligible training could be expanded to include remediation and training for job shifting as well as in-job advancement. 7) If vast improvements in human capital accounting can be made, some form of human capital depreciation might be a possibility -- as is currently done in professional sports.

5. An Emphasis on Private Education and Training Over Job Creation -- Policies that emphasize job creation exclusively are self-defeating where the ultimate goal is permanent employment and increased productivity. Wage subsidies of various kinds do create jobs. Yet, those jobs tend to be of the low wage/low productivity sort that are eliminated first when firms face declining markets or adapt to new technologies. Permanent employment and increased productivity are realizable only when firms both hire and invest in workers.

Analysis of the current labor market supports such a view. The alarming growth in low wage/low skill jobs characteristic of the nation's recent growth in employment is a legitimate concern. In addition, there is an apparent tendency for for firms to retain workers in whom they have invested resources for search and training irrespective of the business cycle -- what economist call "fixed cost labor" and to last hire and first fire a second tier of workers in whom they dare not invest -- "variable cost labor." The cost of maintaining "fixed cost labor" during an economic downturn encourages underinvestment in private training. An available training subsidy would reduce the cost of trained labor and encourage permanent and productive work for some portion of the "variable cost" labor pool.

6. Job-Specific v. General Education and Training -- There is evidence that our historical emphasis on general education and training is no longer totally appropriate. A variety of economic trends mentioned above suggest the need for more job specific training. There are more than economic currents at work. The demography of the labor market will demand more job-specific training. As the baby boom ages and the incentives for early retirement recede due to inflation and legislative changes in retirement law, the clientele of the education and training enter prise will age. If fertility rates hold steady or decline

still further, the education and training clientele will become more female. An older work force will require more direct job training and retraining. The complexity of work decision among adults will require more sophistication and supportive services. Moreover, as the demography of the work force changes, it is likely that these services will have to be delivered in teaching environments further removed from the traditional classroom and closer in substance and physical location to the world of work.

7. Encouraging A Sub-National v. A Nationwide Perspective -- A reformulation of education and training policies toward more privately based job-specific strategies will require a highly decentralized delivery system. No nationwide policy can account for the geographic and industrial diversity in the American economy. A sub-national focus for education and training policy is best served by delivery systems that allow for education and training decision making at the initiative of private individuals and firms.

A sub-national economic policy perspective will also require a careful sorting of policy making roles. Logically, the Federal government would focus its policies on capacity building in regional, local, firm and worker decision making to encourage well-informed and high quality economic choices. In addition, the

Federal government should encourage linkages and complementarity between public education, training and economic development and the private sector.

Above all, the public authorities should expand the scope and quality of labor market and other economic information to promote complementary information for public and private planning. Economic and labor market information should be sufficiently disaggregate to inform local, firm level and individual economic decisions and be sufficiently homogeneous to provide consistent and reliable nationwide information. Such a neutral service would appreciably improve formal and informal linkages between public and private planning as well as a reliable information base to improve the overall quality of economic decision making without promoting undue public intervention into the private economic sphere.

8. Building Infrastructure For Job-Specific Training -- As the demography of the labor force and the requirements of competitive production more the focus and content of training toward the workplace, new teaching infrastructure will be necessary. The current separation between public, private and firm-based training will need to give way to a more mixed pattern of education and training settings. Public secondary and post-secondary institutions

will need to constantly update their teaching and machine capital if they are to turn out graduates ready for job-specific training. Public and private institutions which intend to retrain experinced workers will need "state of the art" courseware and equipment for teaching if their clients are to be made job ready. If private training is to assume an expanded role in training and retraining, employer based education and training capacity will have to be expanded.

New private institutions that are industry and/or geographically based are likely. There are a variety of devices to encourage such a development without encouraging the growth of underutilized facilities. For instance: 1) Tax credits or expensing could be allowed for equipment used in teaching, facilities, instructors and teaching technology. 2) The cooperative use of job-specific education and training resources could be encouraged by expanding the current gift tax provisions to encourage the transfer and sharing of various kinds of teaching capital among private and public institutions.

9. Preparing the Disadvantaged For Job-Specific Training -- OJT, tax credits and other devices have been successful as strategies for encouraging private hiring of the disadvantaged. Two important caveats condition that success. First, available evidence suggests that these devices have "creamed" only a small segment of the dis-

advantaged clientele who were essentially ready for job-specific training. Oftentimes, especially in the case of tax credits, the the subsidy was accepted subsequent to the selection of the disadvantaged worker. Second, many disadvantaged workers have been hired into low wage/low productivity jobs with little subsequent education and training investment. These private sector employees are among the "variable cost labor pool." They are the last hired during an economic upswing and the first fired during a downturn in the business cycle.

Our prior policies have been only marginally successful in encouraging productive and long-term private employment. Private hiring and job-specific training seems to be the key to permanent labor force attachment. The lessons of our prior experience suggests that a sequence of public treatments leading to private job-specific training would provide the most successful and permanent transition to private employment. Public education and training should end at the point where clients are ready for private job-specific training. For instance, an individual program sequence might include educational remediation, vocational training and public service work. When the disadvantaged client is deemed ready for transition to the private sector for job-specific training, hiring incentives might be awarded in the form of wage subsidies to encourage the transition. In order to ensure that the client will remain privately employed, a further training subsidy in the form of a voucher, OJT support or targeted tax credit for training could be made available to increase the client's saleability for job-specific training in the private sector.

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